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(1) The effective date is the date of the most recent version of the document.

VI. Archival Information[1]

Re-numbering and re-classification of SFCG 6 output documents, Rev 1	12 November, 1992
Decisions of SFCG 7 concerning documents	16 May, 1988
Decisions of SFCG 8 concerning documents	16 November, 1988
Decisions of SFCG 9 concerning documents	1 September, 1989
Decisions of SFCG 10 concerning documents	5 October, 1990
Decisions of SFCG 11 concerning documents	24 April, 1991
Decisions of SFCG 12 concerning documents	5 November, 1992
Decisions of SFCG 13 concerning documents	21 October, 1993
Decisions of SFCG 14 concerning documents	22 September, 1994
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Decisions of SFCG 17 concerning documents	25 September, 1997
Decisions of SFCG 18 concerning documents	17 September, 1998
Decisions of SFCG 19 concerning documents	15 September, 1999
Decisions of SFCG 20 concerning documents	16 November, 2000
Decisions of SFCG 21 concerning documents	4 October, 2001
Decisions of SFCG 22 concerning documents	16 October 2002
Decisions of SFCG 23 concerning documents	25 September 2003

(1) Because of its limited interest to most members, Section VI is not automatically distributed as a part of the Handbook. A copy of Section VI may be requested from the SFCG Secretariat.

INTRODUCTION TO THE SPACE FREQUENCY COORDINATION GROUP (SFCG)

SFCG purpose and objective

The SFCG was established in order to provide a less formal and more flexible environment, as compared to the official organs of the International Telecommunications Union (ITU) (i.e, Radiocommunication Bureau (RB); Radio Communication Study Groups (SG) of the Radiocommunication Bureau), for the solution of frequency management problems encountered by member space agencies. The Terms of Reference and other aspects of SFCG organization and procedures may be found in Section II of the Handbook.

The SFCG is concerned with the effective use and management of those radio frequency bands that are allocated by the Radio Regulations of the ITU to the Space Research, Space Operations, Earth Exploration Satellite, and Meteorological Satellite services. The Group will also concern itself with feeder links and data relay satellites operated in connection with these services, radionavigation satellites (as far as these are used for spacecraft orbit determination) and with satellite-borne radio astronomy (including radar astronomy). Within the formal framework of the Radio Regulations, there is the need and opportunity for international informal agreement among participating space agencies concerning assignment of specific frequencies, and related technical issues.

The principal result of SFCG meetings is the adoption of resolutions and recommendations which express technical and administrative agreements. These agreements may be used by space agencies to make best use of allocated bands and to avoid interference.

The effectiveness of SFCG recommendations depends upon voluntary acceptance and use by member agencies. There is no formal process by which agencies formally agree to accept and be bound by SFCG recommendations.

Agency representatives that participate in SFCG meetings are generally expected to be able to speak for their agencies in an informed way and to be able to influence compliance with SFCG recommendations.

SFCG membership

Admission of new members is governed by Resolution A3-1 (most recent version). A listing of SFCG members and observers may be found in Section V of the handbook.

INTRODUCTION TO THE SFCG HANDBOOK

Purpose of the SFCG Handbook

The purpose of this handbook is to provide the reader with all current Resolutions and Recommendations which describe agreements between agencies that participate in the Space Frequency Coordination Group (SFCG). In addition, the handbook provides background material concerning the formation, history, and methods of the SFCG, a description of the document numbering system and related definitions, and archival data concerning past SFCG action and documentation.

Organisation of the handbook

The handbook is divided into six sections. Section 6 contains archival matter and is of limited interest to most readers; a copy may be requested from the SFCG Secretariat.

Each document in the handbook is identified by a title, date, and an indication of the number of pages. No attempt is made to serially number all pages in the handbook.

Resolutions and Recommendations are additionally identified by a number, according to a system explained in *Classification and Numbering of SFCG Output Documents,* found in section I of the handbook.

CLASSIFICATION AND NUMBERING

OF SFCG RECOMMENDATIONS AND RESOLUTIONS

1. Introduction

SFCG Recommendations and Resolutions are classified by:

type of document;

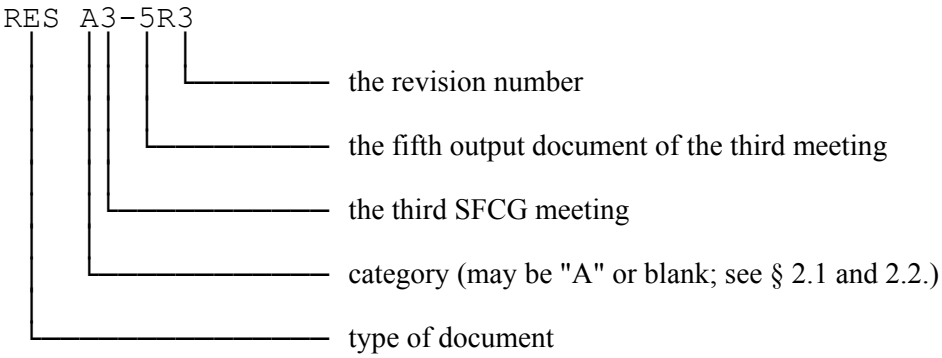
category of subject matter;

the meeting at which the document was originally adopted;

the number of the document as one of the series adopted by that meeting; and

the number of subsequent revisions.

The elements of this classification are embodied in the document number. For example,



2. Description of document classification

2.1 Type of document.

A **Resolution** is an expression of action, intended action, or policy that applies to SFCG members themselves, that is, within the Group. There are two types of resolutions: **Adminstrative**, and **Technical**. Administrative resolutions are indicated by the addition of a category letter "A" to the document number, e.g., RES A2-2R1. See §2.2 below.

A **Recommendation** is an expression of an action, intended action, or policy that is to be pursued by members within their agencies or with respect to other bodies, that is, outside of the Group.

2.2 Category of subject matter.

There are two categories of subject matter:

- administrative, concerning the internal operation of the SFCG; these documents are identified by the letter "A" in the document number
- all other matters that affect member agencies and the radio services of interest to SFCG.

2.3 Meeting at which document was originally adopted.

SFCG meetings are serially numbered. A list of meetings may be found in Section V of the Handbook.

2.4 The number in the series adopted by a particular meeting.

At a particular meeting, adopted documents in each category are sequentially numbered, beginning with 1.

2.5 Revision number.

Each time an existing document is substantially revised (more than an editorial change), a revision number is assigned. The original document carries no revision number; the first revision is Revision 1. Revision numbers are added to the original document number, which does not change. The date of the current revision is the date of the document, found at the bottom of each page in the document.

SFCG RESOLUTIONS AND RECOMMENDATIONS

The following Recommendations and Resolutions were adopted by SFCG 23. The list includes all SFCG Resolutions and Recommendations that are in force. Resolutions, Recommendations, Reports, and Notes for the Record not found in the list are void and have only historical interest.

ADMINISTRATIVE RESOLUTIONS

RES A2-1R4	Date and Place of SFCG Meetings	25 September, 1997
RES A2-2R1	Language of the SFCG	16 May, 1988
RES A2-3R8	SFCG Documentation	4 October, 2001
RES A3-1R2	Admission of New SFCG Members	16 November, 2000
RES A6-1R2	Terms of Reference of the Space Frequency Coordination Group	16 November, 2000
RES A8-1R1	Intersessional Working Groups	25 September, 2003
RES A8-3R2	Preparation for SFCG Meetings	15 September, 1999
RES A8-4R2	Action Items	16 November, 2000
RES A10-1R1	Waivers to SFCG Recommendations	24 April, 1991
RES A11-1R2	Adoption and Revision of SFCG Recommendations	17 September, 1998
RES A12-1R1	Establishment of Procedures for Inter-agency Frequency Coordination	16 November, 2000
RES A12-3R1	SFCG Silver Pin Award for Meritorious Service	25 September, 1997
RES A14-1R2	Rights and Obligations of Member Agencies Relevant to Composition of their Delegations at SFCG Meetings	15 September, 1999

RES A14-2R2	Working Methods of Inter-sessional Working Groups	25 September, 2003
RES A16-1R4	Intersessional Working Group on Frequency Management for the International Space Station (IWG ISS)	25 September, 2003
RES A19-1R3	SFCG Meeting Input Documents	25 September, 2003
RES A21-1	Assistance in the Assignment of Frequencies to Deep Space Missions (Cat. B)	4 October, 2001
RES A21-2R1	SFCG Satellite Database Update Information	16 October, 2002
RES A22-1R1	IWG on Technical & Operational Approaches to Improve the Spectrum Utilization of EESS in the 8025-8400 MHz Band (IWG [X-Band EES])	25 September, 2003
RES A23-1	SFCG Member Emeritus	25 September, 2003
RES A23-2	IWG on technical and operational approaches to address the global deployment of ultra wide band devices (IWG UWB)	25 September, 2003

TECHNICAL RESOLUTIONS

RES 5-9R1	Protection of Frequency Bands Allocated to Passive Sensing and Radioastronomy	4 October, 2001
RES 5-10R1	Interference to Data Collection Systems Operating in the 401-403 MHz Frequency Band Allocated to the Meteorological Satellite Service and the Earth Exploration Satellite Service	17 September, 1998
RES 14-1R1	Use of the Inter-Satellite Service (ISS) 23 GHz Band	3 October, 1996
RES 14-3R1	Microwave Powered High Altitude Relay Platforms	15 December, 1995
RES 15-2R4	Suitable Allocations for Radioastronomy Observations in Space	4 October, 2001
RES 15-3	Proposal for Realignment of Frequency Allocations in the 32 GHz Space Research (Deep Space) (Space-to-Earth) Band	5 December, 1995
RES 15-5R2	Wind Profiler Radar Systems in the Bands near 1000 MHz	17 September, 1998
RES 16-1R3	Sharing between Data Relay Satellite and Proximity	4 October, 2001

	Link Communication Systems and High Population Density Point-to-Multipoint Fixed Systems in the Vicinity of 26 GHz	
RES 17-1R1	Protection of Space Science Services from Terrestrial Service Systems in the Bands 2025-2110 MHz and 2200-2290 MHz	16 November, 2000
RES 18-5	SFCG Software Guidelines	17 September, 1998
RES 19-1	Efficient Use of Spectrum in the 25.5-27 GHz and 37-38 GHz Bands	15 September, 1999
RES 19-3R1	Spectral Separation for IMT-2000 Stations Operating in Bands Adjacent to the Space Research, Earth-Space, Service Band 2025-2110 MHz	16 November, 2000
RES 19-6R1	EESS Active Sensing Requirements > 100 GHz	16 November, 2000
RES 19-7R2	Use of the 7750-7850 MHz Band by non-GSO Meteorological Satellites	16 October, 2002
RES 20-1R1	Appropriate Power Flux Density Limits and Coordination Distances to Protect the Space Research Service (SRS) in the Band 37-38 GHz	4 October, 2001
RES 20-2R2	Optical Communications	25 September 2003
RES 20-3	Protection of RNSS in the 1559-1610 MHz Band	16 November, 2000
RES 21-1	Formation Flying Systems	4 October, 2001
RES 21-2R1	Requirements, Performance, and Protection Criteria for EESS (Passive) Sensors	16 October, 2002
RES 21-3R1	Protection of EESS (Passive) Sensors from Ultra Wideband Device Emissions	16 October, 2002
RES 23-1	SFCG Objectives for World Radiocommunication Conferences	25 September 2003
RES 23-2	Use of Synthetic Aperture Radars in the Band 5250-5570 MHz	25 September 2003
RES 23-3	Use of the Allocation for EESS (active) in the Band 432-438 MHz	25 September 2003
RES 23-4	Expansion of the existing 18.1-18.3 GHz Meteorological Satellite Service Allocation	25 September 2003
RES 23-5	Protection of Future Radio astronomy Observatories in the Shielded Zone of the Moon	25 September 2003

RECOMMENDATIONS

REC 4-3R3	Utilization of 2 GHz Bands for Space Operation	17 September, 1998
REC 5-1R5	Use of the 8450-8500 MHz Band for Space Research, Category A	17 September, 1998
REC 6-1R4	Interference from Space-to-Space Links Between Non-Geostationary Satellites to Other Space Systems in the 2025 - 2110 and 2200 - 2290 MHz Bands	22 September, 1994
REC 6-2R1	Transponder Turnaround Frequency Ratios for Space Research, Category A	1 September, 1989
REC 7-1R4	Transponder Turnaround Frequency Ratios and Radio Frequency Channel Plans for Space Research, Category B	16 October, 2002
REC 11-1R2	Use of the Band 1670 - 1710 MHz for Meteorological Satellite Services	16 November, 2000
REC 12-2	Use of the 14.0 - 15.35 GHz and 16.6 - 17.1 GHz Bands for Space Research, Category A	25 September, 1997
REC 12-4R3	Methods for Reduction of Potential Interference between Systems in the Space Science Services in Densely Occupied Bands	16 October, 2002
REC 12-5R1	Limitations on Earth - Space Link Power Levels	15 December, 1995
REC 13-3R1	Data Relay Satellite Channel Plans for the 23 and 26 GHz Bands	15 December, 1995
REC 14-1	Protection of Deep-Space Earth Stations from Line of Sight Interference in the Bands 2290 - 2300 MHz, 8400 - 8450 MHz, and 31.8 - 32.3 GHz	22 September, 1994
REC 14-2R4	Use of the 37 - 38 GHz Space Research Service Allocation	4 October, 2001
REC 14-3R5 (provisional)	Use of the 8025 - 8400 MHz Band by Earth Exploration Satellites	25 September 2003

REC 15-1R2	Use of the 400.15 - 401 MHz Space Research Allocation for Proximity Links	17 September, 1998
REC 15-2R4	Use of the Band 25.25 - 27.5 GHz for Inter-Satellite (Data Relay Satellite and Proximity Links)	16 October, 2002
REC 17-1R2	Parameters Required for Calculating the Coordination Distance around an Earth Station Operating in the Earth Exploration and Meteorological Satellite Services with Geostationary or Non-Geostationary Space Stations	15 September, 1999
REC 18-1	Use of the Bands 31.3–31.8 GHz and 36-37 GHz for EESS passive Sensing	15 September, 1999
REC 18-2	Minimum Earth Station G/T Requirements for Reception of Non-Geostationary EESS in the 8025-8400 MHz Bands	15 September, 1999
REC 21-1	Spectrum Considerations for Formation Flying Systems	4 October, 2001
REC 21-2R2	Efficient Spectrum Utilisation for Space Science Services on Space-to-Earth Links; Category A	25 September 2003
REC 21-3R1	Use of Sub-Carriers for Space Science Services on Space-to-Earth Links; Cat. A	16 October, 2002
REC 22-1R1	Frequency Assignment Guidelines for Communications in the Mars Region	25 September 2003
REC 23-1 (provisional)	Efficient Spectrum Utilisation for Space Research Service, Deep Space (Category B) in the Space-to-Earth Link	25 September 2003
REC 23-2 (provisional)	Assignment of Differential One-Way Ranging Tone Frequencies for Category B Missions	25 September 2003

ANNEX 8

SFCG-23 REVIEW OF RESOLUTIONS AND RECOMMENDATIONS

ADMINISTRATIVE RESOLUTIONS

DOCUMENT	TITLE	ACTION	REMARKS	SFCG-23 Inputs
RES A2-1R4	Date and Place of SFCG Meetings	NOC		
RES A2-2R1	Language of the SFCG	NOC		
RES A2-3R8	SFCG Documentation	NOC		
RES A3-1R2	Admission of New SFCG Members	NOC		
RES A6-1R2	Terms of Reference of the Space Frequency Coordination Group (SFCG)	NOC		
RES A8-1 revised to RES A8-1R1	Intersessional Working Groups	MOD		SF23-25D
RES A8-3R2	Preparation for SFCG Meetings	NOC		
RES A8-4R2	Action Items	NOC		
RES A10-1R1	Waivers to SFCG Recommendations	NOC		

DOCUMENT	TITLE	ACTION	REMARKS	SFCG-23 Inputs
RES A11-1R2	Adoption and Revision of SFCG Recommendations	NOC		
RES A12-1R1	Establishment of Procedures for Inter-Agency Frequency Coordination	NOC		
RES A12-3R1	SFCG Silver Pin Award for Meritorious Service	NOC		
RES A14-1R2	Rights and Obligations of Member Agencies Relevant to Composition of their Delegations at SFCG Meetings	NOC		
RES A14-2R1 revised to RES A14-2R2	Working Methods of Inter-Sessional Working Groups	MOD		SF23-25D
RES A16-1R3 revised to RES A16-1R4	IWG ISS	MOD	Minor changes to the TOR and membership.	
RES A19-1R2 revised to RES A19-1R3	SFCG Meeting Input Documents	MOD	Deadlines modified	

DOCUMENT	TITLE	ACTION	REMARKS	SFCG-23 Inputs
RES A19-3R2	(IWG Mars Region) Radio-communication Services, Frequency Allocations, and Sharing in the Mars Region	SUP		SF23-17I,43D
RES A20-1R1	Establishment of an SFCG Operations Procedures IWG	SUP		SF23-2D,6D,25D
RES A20-2R2	Intersessional Working Group on Preparations for WRC 2003 (IWG-WRC-03)	SUP		SF23-14D,19D, 20D
RES A20-3R2	Intersessional Working Group on Protection of Passive Services in the shielded Zone of the Moon and the L2 Lagrange Point (IWG L2M)	SUP		SF23-32I
RES A21-1	Assistance in the Assignment of Frequencies to Deep Space Missions (Cat. B)	NOC		
RES A21-2R1	SFCG Satellite Database Update Information	NOC		
RES A22-1 revised to RES A22-1R1	IWG on technical and operational approaches to improve the spectrum utilization of EO satellite services in the 8025-8400 MHz band (IWG X-Band EESS)	MOD	TOR, workplan and membership reviewed	SF23-3D,6D,10D, 27D,28I,33D,40D

DOCUMENT	TITLE	ACTION	REMARKS	SFCG-23 Inputs
RES A23-1	SFCG Member Emeritus	New		SF 23-15/D
RES A23-2	IWG on technical and operational approaches to address the global deployment of ultra wide band devices (IWG UWB)	New		SF23-13D,18D,41D, 57I

TECHNICAL RESOLUTIONS

DOCUMENT	TITLE	ACTION	REMARKS	SFCG-23 Inputs
RES 5-9R1	Protection of Frequency Bands Allocated to Passive Sensing and Radioastronomy	NOC		
RES 5-10R1	Interference to Data Collection Systems operating in the 401-403 MHz Frequency Band allocated to the Meteorological Satellite Service and the Earth Exploration Satellite Service	NOC		
RES 14-1R1	Use of the Inter-Satellite Service (ISS) 23 GHz Band	NOC		
RES 14-3R1	Microwave Powered High Altitude Relay Platforms	NOC		
RES 15-2R4	Suitable Allocations for Radioastronomy Observations in Space	NOC		
RES 15-3	Proposals for Realignment of Frequency Allocations in the 32 GHz Space Research (Deep Space) (Space-to-Earth) Band	NOC		
RES 15-5R2	Wind Profiler Radar Systems in the Bands near 1000 MHz	NOC		

DOCUMENT	TITLE	ACTION	REMARKS	SFCG-23 Inputs
RES 16-1R3	Sharing Between [DRS] and [Prox] Link Communication Systems and High Pop. Density Point-to-Mulitpoint Fixed Systems in the Vicinity of 26 GHz	NOC		
RES 17-1R1	Protection of Space Science Services from Terrestrial Service systems in the Bands 2025-2110 MHz and 2200-2290 MHz	NOC		
RES 18-1R4	SFCG Objectives for WRCs	SUP	New Resolution for the new cycle: RES 23-1	SF23-14D,19D,20D
RES 18-4R3	Allocation for Active Sensors near 5.3 GHz	SUP	New Resolution needed:RES 23-2	SF23-23D
RES 18-5	SFCG Software Guidelines	NOC		
RES 19-1	Efficient Use of Spectrum in the 25.5-27 and 37-38 GHz Bands	NOC		
RES 19-3R1	Spectral Separation for IMT-2000 Stations Operating in Bands Adjacent to the Space Research, Earth-Space, Service Band 2025-2110 MHz	NOC		
RES 19-6R1	EESS Active Sensing Requirements > 100 GHz	NOC		

DOCUMENT	TITLE	ACTION	REMARKS	SFCG-23 Inputs
RES 19-7R2	Use of the 7750-7850 MHz Band by non-GSO Meteorological Satellites	NOC		
RES 20-1R1	Appropriate Power Flux Density Limits and Coordination Distances to Protect the Space Research Service (SRS) in the Band 37-38 GHz	NOC		
RES 20-2R1 revised to RES 20-2R2	Optical Communications	MOD		SF23-21D
RES 20-3	Protection of RNSS in the 1559-1610 MHz Band	NOC		
RES 21-1	Formation Flying Systems	NOC		
RES 21-2R1	Requirements, Performance, and Protection Criteria for EESS (Passive) Sensors	NOC		
RES 21-3R1	Protection of EESS (Passive) Sensors from Ultra Wideband Device Emissions	NOC		
RES 21-4R1	Allocation for EESS (Active) within the band 420-470 MHz	SUP	New Resolution developed after WRC-03 results (RES 23-3)	SF23-24D,31D,37D

DOCUMENT	TITLE	ACTION	REMARKS	SFCG-23 Inputs
RES 23-1	SFCG objectives World Radiocommunication Conferences	New		SF23-14D
RES 23-2	Use of synthetic aperture radars in the band 5250-5570 MHz	New		SF23-23D
RES 23-3	Use of the allocation for EESS (Active) in the band 432-438 MHz	New		SF23-24D,31D,37D
RES 23-4	Expansion of the existing 18.1-18.3 GHz meteorological satellite service allocation	New		SF23-19D
RES 23-5	Protection of Future Radio Astronomy Observatories in the Shielded Zone of the Moon	New		SF23-32D

RECOMMENDATIONS

DOCUMENT	TITLE	ACTION	REMARKS	SFCG-23 Inputs
REC 4-3R3	Utilisation of the 2 GHz Bands for Space Operation	NOC		
REC 5-1R5	Use of the 8450-8500 MHz band for Space Research, Category A	NOC		
REC 6-1R4	Interference from Space-to-Space Links between Non-Geostationary Satellites to Other Space Systems in the 2025-2110 and 2200-2290 MHz Bands	NOC		
REC 6-2R1	Transponder Turnaround Frequency Ratios for Space Research, Category A	NOC		
REC 7-1R4	Transponder Turnaround Frequency Ratios and Radio Frequency Channel Plans for Space Research, Category B	NOC		
REC 11-1R2	Use of the Band 1670-1710 MHz for Meteorological Satellite Services	NOC		
REC 12-2	Use of the 14-15.35 GHz and 16.6-17.1 GHz Bands for Space Research, Cat. A.	NOC		

DOCUMENT	TITLE	ACTION	REMARKS	SFCG-23 Inputs
REC 12-4R3	Methods for Reduction of Potential Interference between Systems in the Space Science Services in Densely Occupied Bands	NOC		
REC 12-5R1	Limitations on Earth-Space Link Power Levels	NOC		
REC 13-3R1	Data Relay Satellite Channel Plans for the 23/26 GHz Bands	NOC		
REC 14-1	Protection of Deep Space Research Earth Stations from Line-of-sight Interference in the Bands 2290-2300 MHz, 8400-8450 MHz and 31.8-32.3 GHz	NOC		
REC 14-2R4	Use of the 37-38 GHz Space Research Service Allocation	NOC		
REC 14-3R4 revised to REC 14-3R5 (provisional)	Use of the 8025-8400 MHz Band by Earth Exploration Satellites	MOD	Revised on the basis of Workshop results and IWG studies, but kept provisional, given the extent of the changes	SF23-3D,6D,10D,27D, 28I,33D,40I
REC 15-1R2	Use of the 400.15-401 MHz Space Research Allocation for Proximity Links	NOC		
REC 15-2R4	Use of the Band 25.25-27.5 GHz for Inter-Satellite (DRS and Proximity Links) and Earth Exploration Satellite Service Applications	NOC		

DOCUMENT	TITLE	ACTION	REMARKS	SFCG-23 Inputs
REC 17-1R2	Parameters Required for Calculating the Coordination Distance ... with Geo-stationary or Non-Geostationary Space Stations	NOC		
REC 18-1	Use of the Bands 31.3-31.8 GHz and 36-37 GHz for EESS Passive Sensing	NOC		
REC 18-2	Minimum Earth Station G/T Requirements for Reception of Non-Geostationary EESS in the 8025-8400 MHz Bands	NOC		
REC 21-1	Spectrum Considerations for Formation Flying Systems	NOC		
REC 21-2R1 revised to REC 21-2R2	Efficient Spectrum Utilisation for Space Science Services on Space-to-Earth Links; Category A	MOD	Revision proposed	SF23-26D
REC 21-3R1	Use of Sub-Carriers for Space Science Services on Space-to-Earth Links; Cat. A	NOC		
REC 22-1 (prov.) revised to REC 22-1R1	Frequency assignment guidelines for communications in the Mars region	MOD	Changes to the attached table proposed	SF23-43D
REC 23-1 (prov)	Efficient Spectrum Utilisation for Space Research Service, Deep Space (Category B), in the Space-to-Earth link	New		SF23-12D

DOCUMENT	TITLE	ACTION	REMARKS	SFCG-23 Inputs
REC 23-2 (prov.)	Assignment of Differential One-Way Ranging Tone Frequencies for Category B Missions	New		SF23-11D, 16D

Administrative Resolutions

Resolution A2-1R4

DATE AND PLACE OF SFCG MEETINGS

The SFCG,

CONSIDERING

a) that each SFCG meeting will be held at the invitation of one of its members in a location convenient to the host;

b) that travel cost in connection with SFCG meetings should be kept within reasonable limits;

RESOLVES

that venues for SFCG meetings be selected in such a way as to facilitate equitable access for all Members and Observers, while at the same time attempting to keep travel cost within reasonable limits.

Resolution A2-2R1

LANGUAGE OF THE SFCG

The SFCG,

CONSIDERING

a) that the use of more than one language in the conduct of its meetings and in its documentation would unduly complicate matters;

b) that the use of more than one language would result in considerable cost, particularly to the hosts of SFCG meetings,

RESOLVES

1. that English will be the official language for the conduct of its meetings and its documentation;

2. that members wishing to avail themselves of translation services. either at meetings or for documentation, are free to do so at their own expense.

Resolution A2-3R8

SFCG DOCUMENTATION

The SFCG,

CONSIDERING

a) that a concise record is required to reflect the deliberations and decisions of the Group;

b) that an organized procedure for input and output documentation will increase the efficient conduct of meetings;

c) that it is nevertheless desirable to minimize documentation formality in order to maintain the flexibility of the Group's proceedings;

d) that it may be necessary to formally transmit information to other entities;

RESOLVES

1. that SFCG input documents will be submitted in the form of:

    - discussion documents (incl. Liaison statements from outside entities)
    - information documents
    - draft Resolutions
    - draft Recommendations

2. that discussion documents are to be provided as background for formal discussion and decision-making by the Group but will not be formally approved by the meeting (see also RES A19-1R1);

3. that information documents are to be provided for the use of SFCG members in the conduct of their work and will be noted in the record of the meeting, but will neither be discussed formally nor approved by the meeting (see also RES A19-1R1);

4. that draft Resolutions and draft Recommendations which are proposed for SFCG adoption will be submitted with supporting discussion documents;

5. that SFCG output documents will generally be written in the form of:

    - Administrative Resolutions, governing the functioning and operation of the SFCG;

- Resolutions, for actions to be taken within SFCG;

- Recommendations, for action proposed by SFCG to be taken by member agencies or other outside bodies;

- Liaison statements for formal transmission of information to other entities;

- Action Items, to describe needed work and to assign responsibility for the conduct of that work in the interval between SFCG meetings (see RES A8-4R2).

- Reports, based on outputs from Action Items, for providing detailed information on issues of concern to the SFCG;

- Decisions, for documenting the results of deliberations, e.g. on requests for waivers to SFCG Recommendations, (see RES A10-1R2), or on other issues, which would not warrant the formulation of a RES A, RES or REC;

6. that Recommendations and Resolutions will be published on the SFCG Website* and will be reviewed at SFCG meetings in accordance with the provisions of RES A11-1R2;

7. that Reports based on output documentation from SFCG Action Items will be published - if they are time-critical - with the Minutes of SFCG Meetings, or in other cases as decided by the SFCG;

8. that the text of new Decisions and Liaison Statements will be published in the minutes of the meeting at which they were adopted, as well as a list of earlier Decisions and Liaison Statements that have been reviewed and remain in force;

9. that Action Items will be published in the minutes of the meeting at which they were adopted, and will be reviewed be the subsequent meeting for further disposition.

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* URL: http://www.sfcgonline.org

Resolution A3-1R2

ADMISSION OF NEW SFCG MEMBERS

The SFCG,

CONSIDERING

that other space agencies may wish to join SFCG;

RESOLVES

that any national or international space agency which is interested in the cooperative development of recommendations for frequency management matters in the support of those services in RES A6-1R2, or applications thereof, may become a member of SFCG;

- by submitting a request for membership to the Executive Secretary, with subsequent approval by the Group; or

- by accepting an invitation from the SFCG, via its Executive Secretary.

Resolution A6-1R2

TERMS OF REFERENCE OF THE SPACE FREQUENCY

COORDINATION GROUP (SFCG)

The SFCG,

NOTING

i) the letter of the Director General of the European Space Agency (ESA) of 16 January, 1980 in which he proposed the creation of SFCG and accepted that ESA provide the permanent secretariat;

ii) the importance of periodically updating its Terms of Reference;

CONSIDERING

a) that the Group has successfully conducted annual meetings since 1980;

b) that the Terms of Reference are updated periodically to maintain current relevance;

RESOLVES

To establish the following Terms of Reference:

SFCG provides a forum for multilateral discussion and coordination of spectrum matters of mutual interest concerning, in particular, the following space radiocommunication services, as defined in the ITU Radio Regulations:

Space research
Space operations
Earth exploration satellite
Meteorological satellite
Inter-satellite
Radionavigation satellite
Radioastronomy and radar astronomy to the extent that they are relevant to spacecraft missions,

The agreed upon results of SFCG work will be expressed in the form of Resolutions, Recommendations, or whatever form may be appropriate for the case. SFCG members will attempt to ensure that findings of SFCG are taken into account by their agencies.

SFCG will:

- facilitate early understanding of present and future plans for space systems and services and of other systems affecting these;
- identify problem areas and coordination needs, and study potential solutions associated therewith;
- identify issues and policy matters relating to the future orderly use of the frequency bands allocated to respective space radiocommunication services;
- suggest courses of action to be taken by SFCG member agencies with regard to current and future frequency needs of the space radiocommunications services identified above;
- identify those matters for which member agencies should facilitate contributions to regional bodies (e.g. APT, CEPT, CITEL), ITU-R Study Groups; or to encourage their administrations to make proposals to ITU WRCs;
- closely cooperate in the area of frequency management with other space agencies as well as with commercial or research users of frequency bands allocated to the services identified above;
- consider any other items of technical, operational, or administrative nature which affect the interests of the Group; and
- maintain strong ties with other international bodies with related objectives.

DECIDES

to accept ESA's offer to provide the permanent Secretariat of the SFCG.

Resolution A8-1R1

INTERSESSIONAL WORKING GROUPS

The SFCG,

CONSIDERING

a) that the agenda for a given meeting may contain one or more very complex issues of an urgent nature;

b) that there is a need to restrict the duration of each meeting in order to minimize the financial burden on hosts as well as attending member agencies;

c) that, consequently, there is an occasional, exceptional need for concentrated effort requiring interaction of members during the period between meetings (the intersessional period);

RECOGNIZING

that it is preferable, whenever practicable, to consider issues within the annual SFCG meetings;

RESOLVES

1. to create, exceptionally, Intersessional Working Groups (IWGs), working between meetings, to deal with major issues of a- longer term nature (more than the period between two consecutive SFCG meetings) that cannot feasibly be completed through the annual SFCG meeting process;

2. to name each IWG in a manner which identifies its area of interest and to provide, by means of a Resolution, the terms of reference of each such group;

3. to assign tasks to each IWG by means of questions and/or action items to be accomplished during the intersessional period;

4. to appoint a chairman or coordinator for each IWG;

5. to consider the work accomplished during the intersessional period, and to assign further tasks if necessary, at a subsequent SFCG meeting.

Resolution A8-3R2

PREPARATION FOR SFCG MEETINGS*

The SFCG,

CONSIDERING

a) the burden placed on the hosting agency by each meeting of the group,

b) the need for effective management of the limited resources of the Executive Secretary, and

c) the desire of each member agency to limit the duration of the meeting,

RESOLVES:

1) that a proposed agenda for the next meeting be distributed with the immediate past meeting minutes,

2) that input discussion documents and reports from Intersessional Working Groups be distributed, by the author, to all members not later than six weeks prior to the published date of the next meeting,

3) that any discussion documents hand-carried for distribution at a group meeting be notified to the Executive Secretary in advance (to facilitate Agenda preparation), and be provided in sufficient numbers to provide one copy per attendee,

4) that any discussion documents not in compliance with Resolves 2) and 3) shall be discussed only if agreed by all members present and if the member present can make timely, private arrangements for duplication and distribution.

* See also RES A19-1

Resolution A8-4R2

ACTION ITEMS

The SFCG,

CONSIDERING

a) that a decision taken by SFCG sometimes requires subsequent action by one or more members:

b) that the effective and timely accomplishment of this action is assisted by a specific description of the task(s), identification of a responsible individual, and establishment of a suitable timetable;

c) that a method of documenting, reviewing, reporting, and completing or terminating each action is helpful, and

d) that such actions are commonly referred to as action items, the action called for should be conducted between two meetings;

e) that a timely response to the action items is vital to the progress of work in the SFCG;

RESOLVES

1. to establish Action Items when appropriate to work specific to the SFCG;

2. to record the establishment of Action Items by means of serial-numbered SFCG documents called Action Items;

3. to include in each Action Item document a description of the action to be taken, the timetable for work to be done, and the name of the responsible individual who is charged with the accomplishment of the Action Item;

4. that individuals who accept responsibility for Action Items will provide quarterly to SFCG delegation heads, via the Executive Secretary a brief statues report;

5. that final disposition of action items should include needed proposals for subsequent Resolutions, Recommendations, Reports, or other actions;

6. that each Action Item will be reviewed at the SFCG meeting following the meeting at which it was established.

Resolution A10-1R1

WAIVERS TO SFCG RECOMMENDATIONS

The SFCG,

CONSIDERING

a) that its Recommendations are aimed at harmonizing and optimizing the use of frequency bands allocated to space radiocommunication services of concern to it;

b) that waivers to these Recommendations may weaken or jeopardize this goal;

c) that there may, however, exist exceptional circumstances under which a member agency may need to request a waiver to the application of a particular Recommendation;

RESOLVES

1. that request for waivers to the application of SFCG Recommendations shall be limited to exceptional circumstances;

2. that requests for waivers shall be submitted to member agencies for their consideration, accompanied by a comprehensive technical note explaining the rationale for the request;

3. that, when a decision is not required before the next SFCG meeting, such waiver may be granted by agreement of member agencies attending the meeting, or,

   when a decision is required before the next SFCG meeting, the requesting agency will propose a decision date, and the waiver will be granted if no objection to the proposed decision date or waiver is received by the SFCG secretariat from any member agency on or before the decision date;

4. that the SFCG may impose technical and/or operational constraints as a prerequisite for granting the waiver.

5. that the SFCG will document the result of its deliberations on a request for a waiver in the form of a Decision. This Decision will be annexed to the minutes of the meeting at which the deliberations took place, or, if they were carried out by correspondence, to the minutes of the subsequent SFCG meeting. Decisions will not be included in the SFCG Handbook.

Resolution A11-1R2

ADOPTION AND REVISION OF SFCG RECOMMENDATIONS

The SFCG,

CONSIDERING

a. that SFCG recommendations are the authoritative expression of agreements between SFCG members;
b. that these recommendations are also referred to and acted upon by agencies not belonging to SFCG;
c. that premature adoption and publication of SFCG recommendations can result in the need for subsequent revision;
d. that frequent revision of recommendations can reduce their effectiveness and the credibility of action by SFCG;
e. that the urgency of adopting a new recommendation should not preclude refinement of the of the text to be finally adopted and published;

RESOLVES

1. that a draft new recommendation which is submitted to an SFCG meeting for consideration, together with its supporting rationale (cf RES A2-3R1), may be adopted by attending member agencies;
2. that the initial adoption of a draft new recommendation shall be on a provisional basis;
3. that each provisional recommendation shall be re-examined at the next SFCG meeting for final adoption or, based on inputs in accordance with ‘resolves 2'of RES A8-3R1, for other action;
4. that provisional recommendations shall be included in the Handbook of the SFCG, clearly identified as provisional;
5. that member agencies may, with suitable care, refer to and make use of provisional recommendations prior to their final adoption;
6. that a proposed revision of an existing recommendation, or a provisional recommendation, shall be submitted together with supporting rationale (cf RES A2-3R1) within the time limits set by RESOLVES 2 of RES A8-3R1, and may be adopted by attending member agencies without further review;
7. that only Recommendations for which modification proposals in accordance with resolves 6 above were received, shall be reviewed at SFCG meetings. [1]

[1] Amendments consequential to ITU-R action, such as WRCs or Study Group decisions, may be introduced without supporting rationale.

Resolution A12-1R1

ESTABLISHMENT OF PROCEDURES FOR INTER-AGENCY

FREQUENCY COORDINATION

The SFCG,

CONSIDERING

a) that the increasing congestion of frequency bands allocated to the space science services calls for an efficient coordination procedure to facilitate individual frequency assignments and to reduce the potential for mutual interference;

b) that the coordination procedure contained in Article S9 of the ITU Radio Regulations does not always provide the desirable flexibility to facilitate inter-agency coordination of frequency assignments;

c) that member agencies could make use ofthe methods contained in the annex to this Resolution to coordinate frequency utilization which may not be readily applicable in Article S9 of the Radio Regulations;

d) that some member agencies, for more than 15 years, have used with great success inter-agency procedures to facilitate coordination of frequency assignments;

e) that the principles underlying these procedures have found to be effective and may also prove useful in inter-agency coordination of frequency assignments among member agencies in general;

f) that inter-agency coordination based on a format common to member agencies will ease the application of the procedural methods;

g) that nevertheless the provisions of Article S9 of the Radio Regulations provides the formal coordination mechanism to be used between administrations when applicable;

RESOLVES

1. that those member agencies wishing to undertake inter-agency frequency coordination with other member agencies give due consideration to the procedures contained in the annexed *SFCG Manual of Procedures for Inter-Agency Frequency Coordination*;

2. that those member agencies wishing to use the procedures contained in the Manual should also inform the Executive Secretary and arrange for inclusion in the Manual, the data for Tables 3.1 and 3.2

SPACE FREQUENCY
COORDINATION GROUP

SFCG MANUAL OF PROCEDURES FOR

INTER-AGENCY FREQUENCY COORDINATION

(Annex to SFCG RES A12-1R1 of 15 November, 2000)

TABLE OF CONTENTS

1. PURPOSE

Member Agencies of the SFCG will share certain radio frequency bands allocated to space services of common interest to these Agencies. As a consequence of this, it is essential that advance planning and post-launch operational coordination be carried out by these Agencies with a view to minimize radio spectrum interference between their missions.

This manual defines method and execution of Inter-Agency frequency coordination among consenting SFCG member agencies.

2. SCOPE

This Manual defines coordination activities associated with the use by SFCG Member Agencies of the relevant frequency bands allocated to Earth-to- Space, Space-to-Earth or Space-to-Space radio-communications in the Radio Regulations of the International Telecommunications Union (ITU), supplemented by SFCG Recommendations, where applicable.

These activities will basically consist of advance planning and operational coordination with respect to the use of relevant frequency bands by their missions and earth stations or for programs in which these Agencies participate. Consideration will also be given to other frequency bands when unwanted emissions are likely to occur.

3. PROCEDURAL APPROACH

3.1 Advance Planning Phase

The discovery of radio interference between active space missions or a potential interference condition in a finalized mission design may result in burdensome emergency solutions involving costly engineering changes and/or costly constraints on mission operations.

The exchange of information concerning the intended use of the radio frequency spectrum obtained during the early stages of the project definition phase will provide timely recognition of potential interference conditions arising from the planned use of the frequency bands such that joint remedial action by the Agencies concerned will result in minimum cost and inconvenience to the Projects concerned.

3.1.1 Description of Activities

In order to carry out advance planning of frequency utilization during the preparation for, and conducting of, multiple simultaneous flight missions, the Agencies will assume the following responsibilities:

A. Identify, at the earliest possible stage, space missions susceptible to interference from, or likely to cause interference to the other Agency's space operations.

B. At the earliest possible stage, provide to the other Agency information about proposed use of frequencies in, or adjacent to, the space service frequency bands. This will, generally consist of the information contained in the Data Set Specifications (see Chapter 6) and, at a minimum of that required in Appendix S4 of the ITU Radio Regulations.

C. In the event that a potentially serious conflict is identified, the Agency discovering the conflict will take the necessary steps to identify areas requiring close mutual coordination between the Agencies. This may include, within the framework of pre-flight planning and mission analysis:

- Provision of relevant trajectory/orbit and telecommunication link specifications for those missions which have been identified as susceptible to interference from, or to be

sources of interference to, space operations of the other Agency.

- Analysis and prediction of the extent of Interference to the discovering Agency's space operations.
- Performance of simulations and/or ground tests, if required and feasible, to determine the susceptibility to interference conditions of the mission operations system.
- Definition of critical operational phases for those missions which have been identified before- hand as being susceptible to interference.
- Development, jointly with the other Agency, of criteria for temporarily turning off telecommunications links, or other measures for avoiding interference.

Resolution of interference cases, following the conclusion of advance planning phase specified in paragraph 3.1.3, will, at the same time, meet the technical information requirements of the official frequency coordination procedures (when applicable) set forth in the appropriate sections of Article S9 of the ITU Radio Regulations.

Consequently, the activities carried out between the Agencies during the advance planning phase will greatly facilitate - and thereby shorten - the official coordination in accordance with Article S9, Section II of the ITU Radio Regulations (when applicable). It can, however, not replace the formal (administrative) exchange of information required by said provision between the Radio Regulatory Authorities, responsible for the notification of the respective satellites.

3.1.2 Interfaces

The interfaces in the Agencies, for the activities carried out in the advance planning phase are listed in Table 3.1.

TABLE 3.1

INTERFACES FOR THE ADVANCE PLANNING PHASE

Agency:

Name of Contact:

Function:

Address:

Phone:

Fax:

Telex:

[Note: Each SFCG Member Agency wishing to participate in this venture is invited to supply this information in the Table 3.1 to the Executive Secretary]

3.1.3 Advance Planning Procedure

The following procedure defines the framework within which the advance planning of frequency use will be carried out.

The initiation of advance planning of frequency use at the very early stages of a mission design is motivated by recognition of the following facts:

- The mutual coordination of frequency use is, by its very nature, rather time-consuming.

- The implementation of design modification that may be required in the course of the coordination procedure becomes increasingly more costly as the project advances through its design and qualification stages.

Consequently, even very preliminary information originating during the early phases of mission design can be most helpful in identifying potential areas where frequency conflicts may occur.

The procedure for advance planning of frequency use is outlined in a flow diagram (Figure 3.1). Deadlines for completion of the various tasks are indicated as a guideline. However, staff in charge of carrying out a certain task are invited to make every effort to reduce overall duration of the procedure.

Step 1: Initial Announcement of Intended Use of Frequency Bands

Objective: Initiation of procedure for advance planning phase

Responsibility: Agency A (announcing Agency)

Preliminary exchange of information on planned missions prior to, or during the mission definition phases.

Agencies will exchange, as soon as available and if possible, at least three (3) years prior to the scheduled launch date, summary-type information on mission design, mission objectives, trajectory/orbit data, scheduled launch time, mission lifetime*. Frequency information should include the allocated frequency bands that will be used, the planned centre frequencies, and occupied bandwidths. To expedite the coordination procedure, alternative frequency bands should be included whenever possible.

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* The data set for preliminary examination of potential interference is described in Section 6.1.

The information transfer should take place at the earliest possible time even though some of the above-listed information may be tentative or incomplete.

Step 2: Preliminary Examination of Potential Interference

Objective: Request for identification of interference potentials

Responsibility: Agency B

Upon receipt of the preliminary coordination data forwarded by the announcing Agency (Agency A), the recipient Agency (Agency B) will promptly (preferably within one week) acknowledge receipt and proceed to examine the matter with regard to interference which is likely to be caused to, or by, its missions and/or the services rendered by its networks(s) in operation.

Within an overall period of approximately one month from the acknowledged date of receipt of the coordination data, the recipient Agency will notify the announcing Agency of its preliminary findings on interference potentials. If a preliminary assessment is not possible, the recipient Agency will indicate the reasons and will make such suggestions as are possible with respect to a satisfactory solution to the problem. The announcing Agency will acknowledge receipt (preferably within one week) of the preliminary assessment of interference potentials and will notify the other Agency within a period of 1 month of its preliminary assessment of the exchanged information.

Step 3: Detailed Examination of Potential Interference (if required)

Objective: Joint in-depth investigation of potential interference

Responsibility: Agencies A and B

The Detailed Examination will be performed simultaneously by the Agencies concerned for all missions identified as having interference potential. Since this work requires additional resources and support from numerous internal organizations, the following procedure will be followed:

A. If more than two missions (i.e. one "mission pair") are involved in an interference case, it may be advisable to develop a cross-reference matrix containing the Agency A and B mission pairs which are identified in Step 2 as having interference potentials.

B. The matrix should identify those missions requiring priority analysis together with the completion dates.

C. After priorities for the Detailed Examination have been mutually established, the detailed analysis of the high priority mission pair will be initiated. If Agency B suspects potential interference from signals radiated by the proposed transmitters of Agency A, it will perform the Detailed Examination of the interference potential. Agency B will request the baseline information contained in Data Set Specifications for Advance Planning of Frequency Use as outlined in Section 6 of this document. This information will be provided by the interferer Agency.

The Data Set will be furnished by Agency A within approximately one month and Agency B should complete the detailed examination within a period of two months. The result of this examination will be forwarded to Agency A for concurrence of the findings. This concurrence should be provided within one month after the receipt of the Detailed Examination.

The anticipated rate and duration of potential interference occurrences should be estimated from scheduled launch of the new mission to the end of its normal mission lifetime. However, in order to accommodate possible launch delays and/or extensions of the mission lifetime, the end date of the normal mission lifetime should be appropriately extended for the purpose of interference avoidance planning.

Step 4: Joint Analysis and/or Test/Simulations (if required)

Objective: Joint attempt to solution of interference problem

Responsibility: Agencies A and B

In case Agency B, in Step 3, had not succeeded in solving the interference problem, but regards as beneficial joint analysis and/or tests/simulations with A, it shall inform the latter within two weeks of its intent to initiate Step 4. This announcement shall, if possible, already include a technical outline for the proposed joint analysis and/or test/simulations program.

Step 5: Initiation of Remedial Action (if required)

Objective: Implementation of solutions to interference problems

Responsibility: Agency A and/or B

If the results of Step 4 have established the existence of unacceptable interference, the Agencies will jointly determine whether there are feasible engineering or procedural solutions for solving or reducing the problem. Any mutually acceptable engineering solution(s) will be implemented immediately. In the absence of engineering solutions the Agencies concerned will determine whether post launch operational procedures can be adequately coordinated or modified to alleviate the interference problem.

If adequate post-launch operations coordination can alleviate the interference problem the

Agencies concerned will apply the general operations coordination procedures, called up in 3.2.3. They will jointly develop mission- specific operations coordination procedures, as required, to be implemented for post-launch operations. The responsibility for these operations-related activities rests with the offices identified in Table 3.2. The offices identified in Table 3.1 will be kept informed on the progress made in the development of the mission-specific operations procedures.

3.2 Post-Launch Operations Phase

3.2.1 Description of Activities

In all cases in which Step 5 of the advance planning procedure (paragraph 3.1.3) resolves the interference problem through the implementation of mission-specific coordinated operations procedures, the responsible Agency Operations Offices identified in Table 3.2 shall:

- Establish general operations coordination procedures for the satellites networks concerned, as required.

- Establish mission-specific operations procedures with
the framework of the general operations coordination procedures as required.

- Schedule mission operations support so as to minimize RFI.

- Coordinate the resolution of immediate operations problems as necessary.

- Notify the Agency Frequency Manager of major interference cases, the circumstances involved, the action taken, and whether any additional action is required.

3.2.2 Interfaces

The Agency interfaces for the execution of post-launch operations coordination are listed in Table 3.2.

3.2.3 Operations Coordination Procedure

General operations coordination procedures by which Agencies concerned exchange operational information for the resolution of possible and/or actual Radio Frequency Interference (RFI) problems will be developed, as required, by the offices identified in Table 3.2.

The general operations coordination procedures may be complemented by mission-specific operations procedures, if required.

General and mission-specific operations coordination procedures do not form part of this Manual.

TABLE 3.2

INTERFACES FOR POST-LAUNCH OPERATIONS COORDINATION

Agency:

Network:

Name of Contact:

Function:

Address:

Phone:

Fax:

Telex:

[Note: Each Agency wishing to participate in this venture is invited to supply the information in the above Table to the Executive Secretary.]

4. PRIORITY GUIDELINES

These priority guidelines apply in the case of interference, actual or potential, involving space missions of SFCG Member Agencies. They are meant as a tool for the treatment of interference cases in the framework of the mission specific operations coordination procedure described in 3.2.3.

Priority 1 Events critical to safety of human life (manned missions).

Priority 2 Time-critical events where interference would seriously threaten the successful completion of the mission objectives, i.e. events that can neither be revoked nor be rescheduled.

Priority 3 Scheduled time-critical events of missions having limited opportunities for achieving mission objectives, i.e., events with very limited re-scheduling potential.

Priority 4 Events of missions which can be scheduled with subsequent opportunities available but which are mandatory for achieving mission objectives.

5. EXTENSION AND CANCELLATION OF FREQUENCY ASSIGNMENT

The Agencies concerned will inform each other, at the earliest possible date of any:

- Intended extension of the use of a frequency band beyond the previously scheduled termination,
- Predicted or unscheduled cancellation of a frequency assignment.

This information, which is vital to the orderly execution of advance planning phase and the conscientious management of the limited frequency resources, shall be forwarded between the offices identified in Table 3.1, Paragraph 3.1.2. It will also be duly reflected in the SFCG Satellite Data Base entries for the spacecraft concerned.

6. DATA SET SPECIFICATION FOR ADVANCE PLANNING OF FREQUENCY USE

The specification of the required Earth-to-Space, Space-to-Earth and Space-to-Space radio link data set necessary to establish radio spectrum interference potentials are listed in this section.

6.1 Data Set for Preliminary Examination of Potential Interference (3.1.3 Step 2)

The data set for the preliminary examination of potential interference shall be supplied using the format of the SFCG Satellite Data Base.

6.2 Data Set for Detailed Examination of Potential Interference

This data set shall be an expanded version of the one described in 6.1. Its contents shall be defined by the offices defined in Table 3.1 on a case by case basis.

7. REVISION AND AMENDMENT CONTROL

The SFCG Procedures Manual for Inter-Agency Frequency Coordination shall be subject to additions, deletions and amendments, as the need arises, by agreement among SFCG Members. The authority for revisions will rest with the SFCG.

The execution of the revision will rest with the Executive Secretary of the SFCG.

8. APPLICABLE DOCUMENTS

- ITU/Radio Regulations (Ed. 1998)
- Final Acts of WRC-2000
- SFCG Resolutions and Recommendations

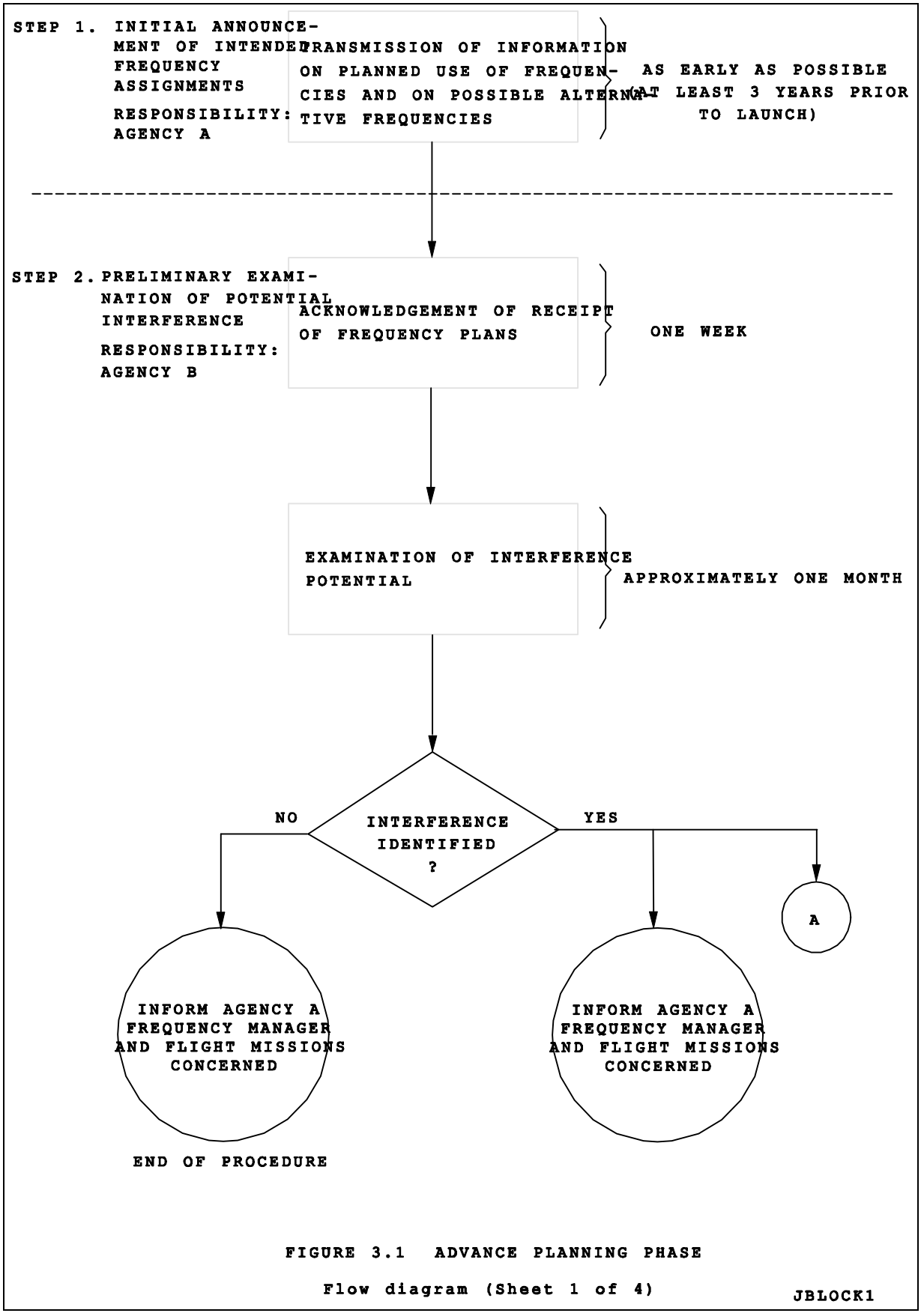

FIGURE 3.1 ADVANCE PLANNING PHASE

Flow diagram (Sheet 1 of 4)

JBLOCK1

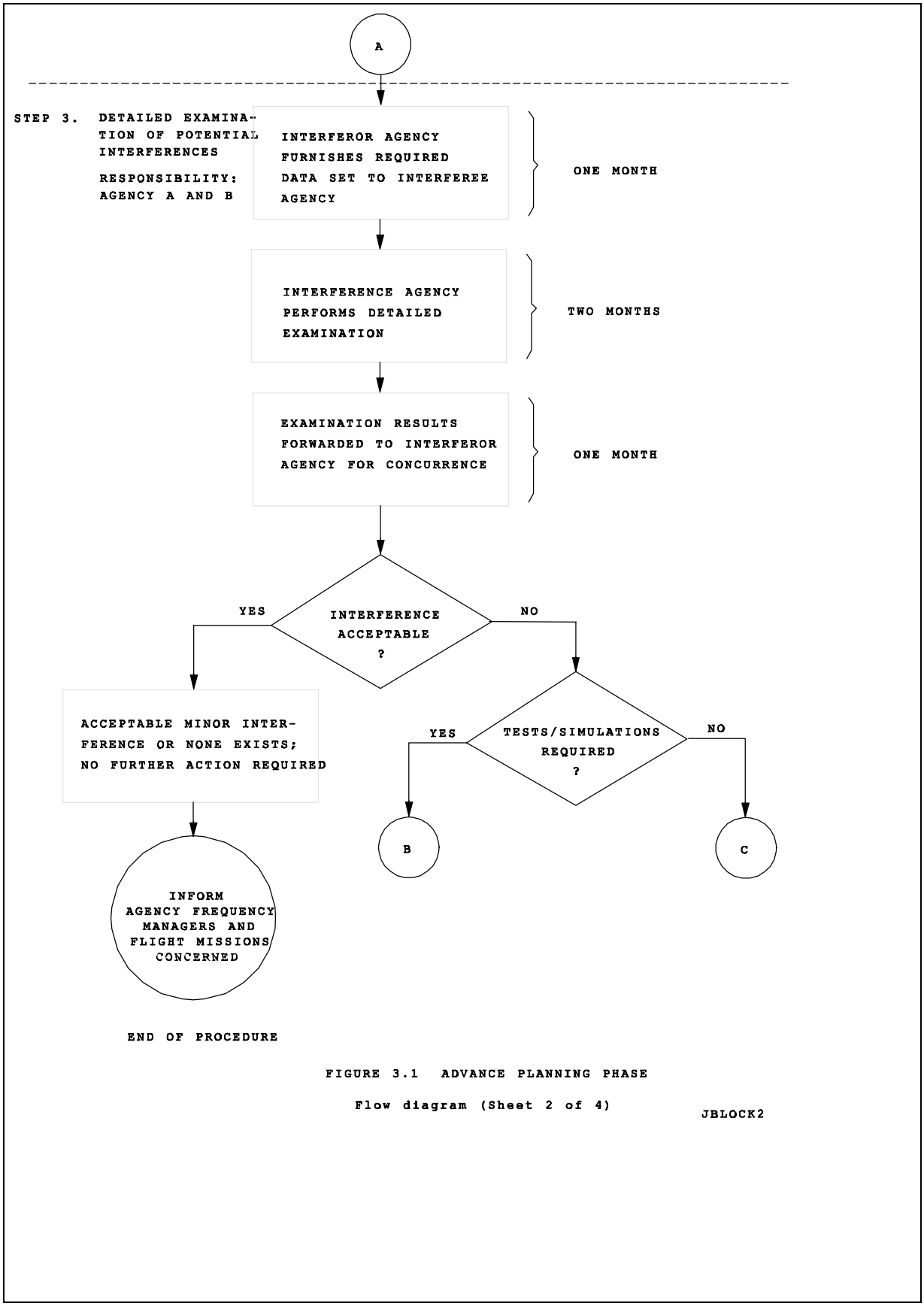

FIGURE 3.1 ADVANCE PLANNING PHASE

Flow diagram (Sheet 2 of 4)

JBLOCK2

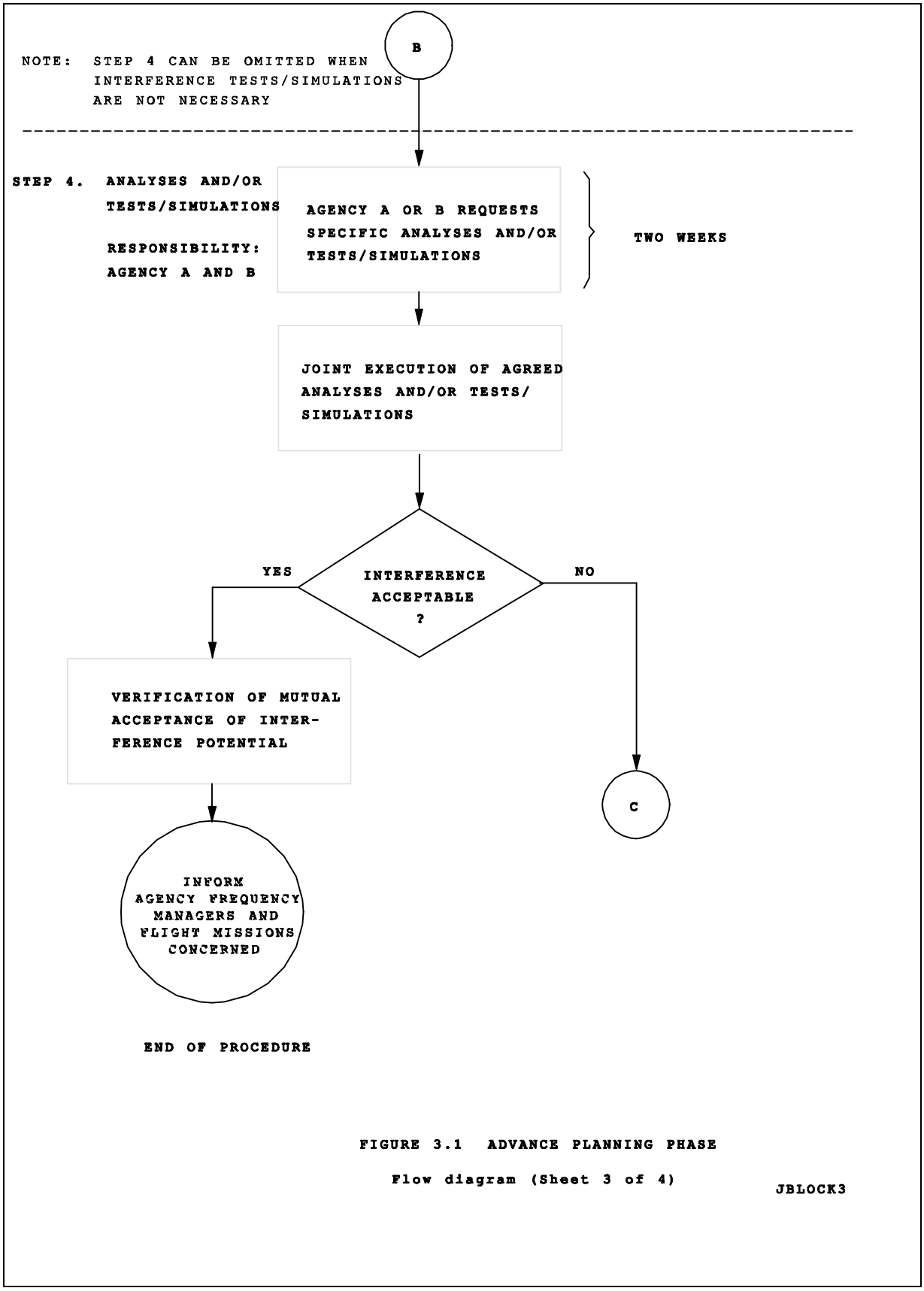

FIGURE 3.1 ADVANCE PLANNING PHASE

Flow diagram (Sheet 3 of 4)

JBLOCK3

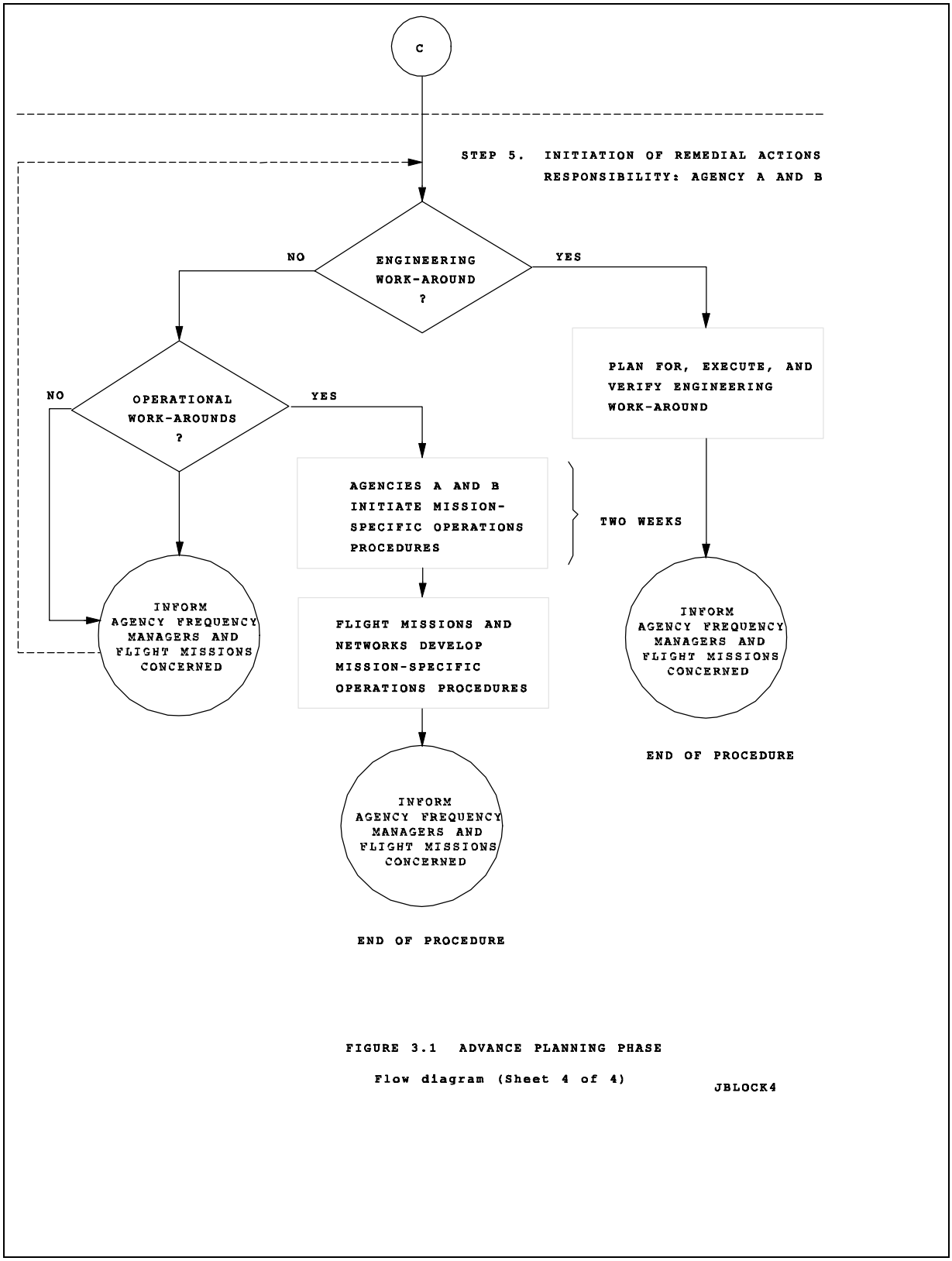

FIGURE 3.1 ADVANCE PLANNING PHASE

Flow diagram (Sheet 4 of 4)

JBLOCK4

Resolution A12-3R1

SFCG SILVER PIN AWARD FOR MERITORIOUS SERVICE

The SFCG,

CONSIDERING

a) the desire of the SFCG to reward meritorious service with a symbolic recognition;

b) the symbolism of the metallic element silver as a durable, hard-wearing material;

ACKNOWLEDGING

the generous gift from NASA of a number of Space Frequency Coordination Group lapel pins in silver finish;

RESOLVES

1. that at each of its annual meetings, one Silver Pin Award may be awarded to the nominee who is judged to have provided meritorious service to the group;

2. that each Silver Pin Award Holder may make, in writing with the appropriate supporting reasons, one nomination for this award for consideration at the annual meeting;

3. that such nominations shall be submitted to the Executive Secretary no later than six weeks prior to the meeting at which they are to be considered;

4. that the Executive Secretary shall prepare from the nominations received, a ballot listing the name and supporting rationale concerning each nominee;

5. that the selection of who shall receive the awards from among the nominees shall be made by open ballot conducted among the existing cadre of Silver Pin holders attending the current meeting;

6. that a record of all holders of this award will be kept in the SFCG Handbook.

Resolution A14-1R2

RIGHTS AND OBLIGATIONS OF MEMBER AGENCIES RELEVANT TO COMPOSITION OF THEIR DELEGATIONS AT SFCG MEETINGS

The SFCG,

CONSIDERING

a) that the composition of delegations at SFCG meetings has generally been comprised of representatives of space agencies, with fundamental interest in space science services;

b) that space agencies generally maintain centres of technical and operational excellence from which expertise in current space science requirements and technologies may be drawn;

c) that in the past, space agencies occasionally have invited competent experts from other disciplines;

d) that a broader interpretation of the composition of delegations will be essential due to dynamic changes in the telecommunications environment;

RECOGNIZING

a) that much of the success of the SFCG has been based on the collegial interactions of experts from the member agencies' centres of excellence, in establishing common positions for the worldwide use of space science frequency allocations;

b) that annual SFCG meetings are held at the invitation of an SFCG member agency and that the financial burden on the host agency as well as on the SFCG Secretariat must be kept within reasonable limits;

RESOLVES

1. to encourage members to consider, when composing their delegations, the inclusion of current technological and operational expertise in appropriate fields;

2. to request heads of delegation to inform the SFCG Secretariat, in due time prior to the registration deadline for an annual SFCG meeting, of the names of non-member agency staff planning to attend the meeting (this does not apply to staff figuring in the official SFCG Members and Observers List);

INVITES

member agencies to exercise their rights in determining the composition of their delegations to SFCG meetings, in order to fulfill their obligations towards enhancing the performance and status of the SFCG as a competent and informal group,

FURTHER INVITES

member agencies to take into consideration Recognizing b) above when determining the size of their delegation.

Resolution A14-2R2

Working Methods of Intersessional Working Groups

The SFCG,

CONSIDERING

a) that Intersessional Working Groups (IWGs) may have the exceptional need to meet in person in order to review the current status of work in progress, to exchange new ideas, and to plan for future work actions;

b) that travel to separately scheduled meetings for this purpose can be an expensive, and in some cases unacceptable burden on the participants;

c) that the annual meetings of the SFCG itself provide the commonality of location and date that brings together the participants in these IWGs;

d) that normally the work of an IWG can be accomplished by correspondence;

RESOLVES

1. that IWGs accomplish their work predominantly by electronic means;

2. that IWG members make use of the SFCG Web site to facilitate document exchange and discussion as appropriate throughout the intersessional period;

3. that IWG chairpersons report the status of the IWG's work to the annual SFCG meeting;

4. that the SFCG Secretariat provide a brief period of meeting time for each Intersessional Working Group for organizing its work plan as needed, in connection with the annual SFCG meeting;

5. that in-person IWG meetings outside the annual SFCG meeting periods should be limited to exceptional circumstances.

6. that the final output of a IWG will be in the form of a report suitable for publication as appropriate by SFCG.

Resolution A16-1R4

INTERSESSIONAL WORKING GROUP (IWG) ON FREQUENCY MANAGEMENT FOR THE INTERNATIONAL SPACE STATION (ISS)

The SFCG,

CONSIDERING

a) that the International Space Station (ISS) is an international manned space program lead by inter-government agreements between participating countries and controlled by national space agencies;

b) that current Space Frequency Coordination Group (SFCG) member agencies contributing to the ISS include Canadian Space Agency (CSA), European Space Agency (ESA), National Aeronautics and Space Administration (NASA), National Space Development Agency of Japan (NASDA), Russian Aviation and Space Agency (RASA), and Italian Space Agency (ASI), hereafter referred to as the International Partners, along with any future participating agencies;

c) that, in accordance with Resolution A8-1, SFCG-16 created an Intersessional Working Group called International Space Station (IWG ISS);

d) that, the ISS Radio Frequency (RF) Coordination Manual (SSP50423) has been adopted by the Frequency Managers of the International Partners;

e) that, in accordance with the relevant provisions in Articles 9 and 11 of the International Telecommunications Union (ITU) Radio Regulations (RR), transmitting/receiving systems of international programs shall be advance-published and notified in the ITU (RR 11.4) by the respective national administrations working with the above agencies;

f) that advance information shall be sent to the ITU no later than two years before the planned date of bringing the transmitting/receiving systems into use (RR 9.1) and that notices relating to the frequency assignments of these systems shall reach the ITU no later than three months before the assignments are brought into use (RR 11.25);

g) that up-to-date and complete technical information about all ISS transmitting/receiving systems operating on or in its vicinity (within 50 km) should be disseminated as soon as it becomes available in order to facilitate timely completion of electromagnetic compatibility and radio frequency interference analyses;

h) that any potential modifications to frequencies and technical parameters, which become necessary as a result of the international notification or other reasons, must be reported immediately in order to keep up-to-date records of all ISS transmitting/receiving systems operating on or in its vicinity (within 50 km).

RESOLVES

1. that the IWG ISS has the following terms of reference:

   – to facilitate the frequency management and ITU registration for national participants providing ISS radio equipment;

   – to facilitate the submission to the Chairman of the IWG ISS the current data on all ISS transmitting/receiving systems operating on or in its vicinity (within 50 km) for recording into the relevant section of the SFCG Satellite Database (SSDB);

   – to facilitate the sharing of the relevant section of the SSDB and the dissemination of plans for operational uses of all ISS transmitting/receiving systems planned for use on or in its vicinity (within 50 km);

   – to recommend to the relevant program offices frequency bands for new systems, experiments and experiment support facilities which are proposed as a result of evolving program requirements;

   - to facilitate the resolution of interference issues to and from the ISS radio equipment between SFCG member agencies.

2. that the IWG ISS urges SFCG member agencies who contribute to ISS:

   – to conduct, in compliance with the relevant provisions of the ISS RF Coordination Manual, the necessary radio frequency interference (RFI) and electromagnetic interference (EMI) analyses based on information provided in the SSDB to facilitate coordination of ISS radio frequency spectrum usage;

   – to promulgate the results of electromagnetic compatibility and radio frequency interference analyses performed by SFCG member agencies who contribute to ISS;

   – to provide guidance to the relevant program offices regarding ISS RFI/EMI incompatibility and to recommend solutions to radio frequency spectrum usage issues;

3. that Ms C. Sham (NASA) is the chairman of the IWG ISS, and the members are:

ASI	L. Garramone
CSA	J. Chambers
CSA	M. Gaudreau
ESA	U. Christ

ESA	J. Gerner
NASA	R. Porter
NASA	F. Manshadi
NASA	B. Kaufman
NASDA	S. Fukuda
NASDA	T. Mukai
RASA	M. Vasiliev
RASA	A. Martynov
IUCAF	W. Van Driel
CMA	Z. Sun
CMA	J. Yang
NSPO	J. Yaung

Resolution A19-1R3

SFCG MEETING INPUT DOCUMENTS

The SFCG,

CONSIDERING

a) that a major purpose of SFCG meetings is to promote the open discussion and resolution of spectrum management issues among representatives of international space agencies;

b) that discussion and resolution of issues requires an understanding of agency' requirements and positions and this is best accomplished by the exchanging Discussion Documents, described in Resolution A2-3, in advance of the meeting;

c) that SFCG meetings are generally held once each year and the amount of time available for discussing and resolving each issue is necessarily limited;

d) that the number of documents which can be discussed at an SFCG meeting must also be limited;

e) that delegates to an SFCG meeting must have sufficient time to read, understand, and prepare their responses to positions advocated in Discussion Documents;

f) that another major purpose of SFCG meetings is to provide for the efficient dissemination of information among agencies on matters related to use of the RF spectrum;

g) that such exchange of information can be accomplished efficiently with Information Documents, provided for in Resolution A2-3, setting forth agency plans or providing other relevant information;

h) that there is no need to limit the number of Information Documents, since they are not discussed at meetings;

i) that manpower and financial constraints make it impractical to ask a hosting agency or the SFCG Secretariat to reproduce sufficient copies of documents for all delegates;

RESOLVES

1. that agencies prepare and submit Discussion Documents only on matters in which they have a material interest;

2. that Discussion Documents shall have <u>all</u> of the characteristics listed in Table 1;

3. that papers not possessing <u>all</u> of the characteristics found in Table 1 shall be designated as Information Documents;

4. that electronic distribution via the SFCG Web Site is the preferred method for distributing SFCG documents;

5. that all input document use the standard format given in the ANNEX;

6. that Discussion Documents to be placed on the SFCG Web Site shall be transmitted to the SFCG Web Coordinator electronically, using one of the formats contained in Table 2, at least two (2) weeks prior to the first day of an SFCG meeting;

7. that Information Documents to be placed on the SFCG Web Site shall be transmitted to the SFCG Web Coordinator electronically, using one of the formats contained in Table 2, at least one (1) week prior to the first day of an SFCG meeting;

8. that agencies shall inform the SFCG Secretariat of the title and request a document number for their Discussion Documents not less than three (3) weeks and for their Information Documents not less than two (2) weeks prior to the first day of an SFCG meeting;

9. that agencies not distributing documents via the SFCG Web Site should send their documents by an international courier service, such as DHL or Federal Express, directly to all persons named in the *List Members and Observers* in the Minutes of the prior SFCG so that Discussion Documents will be received no later than two (2) weeks prior to the first day of an SFCG meeting;

10. that documents hand carried to the SFCG meeting shall be designated as Information Documents and may not be distributed unless sufficient copies are provided for all delegates at the meeting.

11. that the time limits set forth above do not apply to documents outside the control of the SFCG, such as documents originating within the ITU, CEPT, CITEL, APT.

NOTES

that the SFCG Web Coordinator has agreed to use his *best efforts* to place documents received in a proper electronic format on the SFCG Web Site within two (2) days of receipt;

Table 1: Attributes Required to be Designated a Discussion Document

ATTRIBUTE	DEFINITION
Relevancy	Must relate to a matter acceptable for discussion at the SFCG meeting to which it is submitted.
Action Specific	Must request a specific action or modification of existing policy, or provide data needed for an action or policy.
Justification	Must fully justify (technically or administratively) the specific action requested.

Table 2: Acceptable Formats and Application Programs for SFCG Documents

FORMAT / APPLICATION	DESCRIPTION
PDF	Portable Document Format (Adobe Acrobat Reader)
MS Word	Microsoft's word processing software (version 2000 or earlier)

ANNEX

SFCG-XX **SFXX-NN/D**
DD-DD Month, YYYY
City, State or Province, Country

MEMBER AGENCY OR ORGANIZATION

DOCUMENT TITLE

(SFCG AGENDA ITEM OR ACTION ITEM REFERENCE IF APPLICABLE)

Abstract

This is a short one paragraph abstract of the purpose, objective and conclusions presented in the input document.

Resolution A21-1

ASSISTANCE IN THE ASSIGNMENT OF FREQUENCIES TO DEEP SPACE MISSIONS (CAT. B)

The SFCG,

CONSIDERING

a) that the proper assignment of frequencies to deep space probes (Cat. B missions) is essential to mission success;

b) that this assignment process demands the appropriate software tools, significant expertise, and a complete knowledge of the existing and planned assignments to Cat. B missions, as well as their technical parameters, trajectories, mission timeframes, and planned events;

c) that NASA/JPL has carried out successfully for many decades the task of frequency assignment to NASA and some third party's deep space missions;

RECOGNISING

the offer by NASA/JPL to assist SFCG Member Agencies, at their request, with frequency assignment tasks for Cat. B missions;

RESOLVES

to accept the offer by NASA/JPL, and

ENCOURAGES

SFCG Member Agencies planning deep space missions to take advantage of the assistance offered by NASA/JPL.

Resolution A21-2R1

SFCG SATELLITE DATABASE UPDATE INFORMATION

The SFCG,

CONSIDERING

a) that it is important that SFCG maintain an up-to-date satellite database for frequency planning and RFI analysis;

b) that data from non-SFCG member spacecraft containing ITU registered frequencies are of interest;

c) that the integrity of the SSDB, i.e. its completeness and the accuracy of its data, is of utmost importance to render it a tool that can be reliably used by SFCG members for making new assignments;

d) that frequency assignments based on a lack of information can result in costly redesign or in severe operational constraints on the satellite project concerned;

RESOLVES

1. that member agencies update the database information on their spacecraft projects as soon as it becomes available;

2. that member agencies identify an "agency approval person" who will be the primary agency contact and responsible for the accuracy of their agency's mission data*;

3. that member agencies supply current data on national non-SFCG member spacecraft in the bands used by SFCG members whenever possible;

4. that the information is incorporated into the SFCG database as soon as any information becomes available, even if incomplete;

5. that the information to be supplied is in accordance with the parameters listed in the SFCG satellite database;

6. that instructions on the use of the SFCG database are provided in Annex 1;

7. to encourage its Member Agencies to use the procedure annexed to RES A12-1R1 for solving their inter-agency frequency coordination cases.

[Annex 1 (from SF22-29) is attached]

* The Secretariat will identify in the Members' and Observers' List the nominated agency approval person.

User's Guide for the SFCG Satellite Database (SSDB)

Introduction

The SFCG database was designed as a web application. It was intended for multiple agencies to be able to enter data into the same database concurrently. This approach ensures that all users have access to the most up-to-date version of the mission data. The database is hosted on a NASA server. Accounts are password protected and coordinated through a single account administrator. The application is accessible via the SFCG web page.

Account Levels

There are two user levels for the database application: *entry* and *approval*. Each agency may have multiple entry accounts, but will be assigned only one approval account. An entry-level user will be able to access the entry forms and provide data for any mission that belongs to their agency. During this data entry process, the mission data is only accessible to that agency via the entry forms. The data will not appear during searches and will not be accessible to any other agencies. Each agency will appoint a single point of contact to have approval authority. This person has the responsibility of verifying the data entered for their agency's missions and officially submitting the mission to the database so that the data is accessible to other agencies via the on-line search engine.

Database Structure

The database is designed around the notion that all of the equipment is defined first, and then linked together. An example diagram of the database structure is shown in Figure 1. This figure shows only the satellite branches associated with the mission; there would be corresponding branches for each ground station or relay satellite used (not shown in the interest of space).

Level 1 of the figure contains all of the high-level mission data. This information would include parameters such as mission name, launch date, point-of-contact, etc. Level 2 identifies the stations, both earth and space, associated with the mission. Although most space research and Earth exploration missions have a single satellite, it is possible that a mission may have a target and chaser configuration, or be composed of a constellation of satellites. For this reason, the user could add any number of satellites associated with the mission.

Level 3 associates the RF equipment with the station(s). Figure 1 identifies the transmitters and receivers as being invisible to the user. These are only needed to identify an antenna as transmitting or receiving when connected to create the links; there is no data collected for this equipment. For each station (e.g. a satellite in Figure 1), antennas and/or sensors are defined in the third level. It should be noted that antennas should be thought of in logical terms, and not as physical entities. That is, if a single physical antenna were used to transmit and receive at S-band, and transmit at X-band, it would be defined as three logical antennas in the database. Sensors are only defined for satellites.

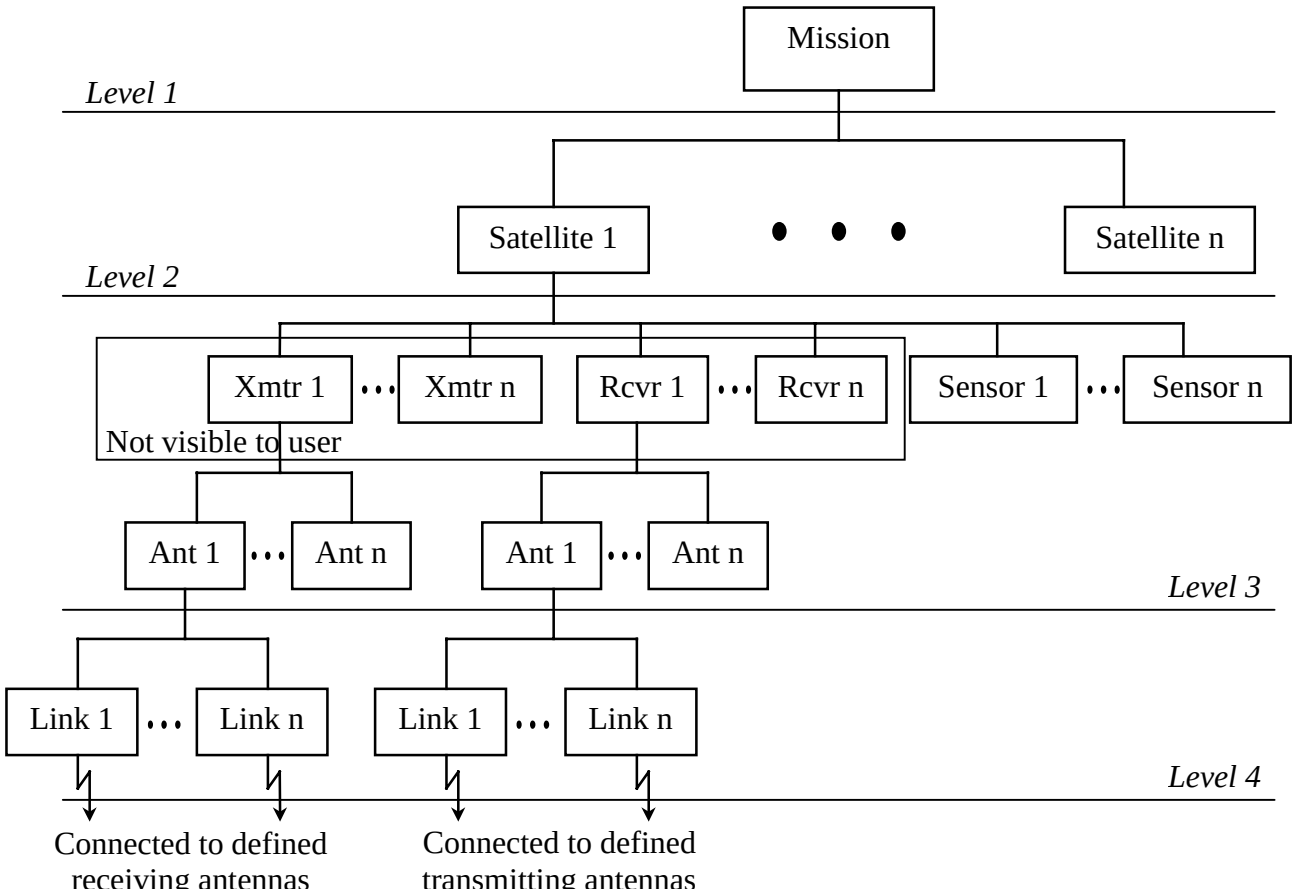

Figure 1: Database Structure Example

In Figure 1, the section labeled as Level 4 designates the portion of the data that defines the link parameters. First a connection is defined from a transmitting to a receiving antenna. Additionally, link and channel communications parameters are included in this section.

Workflow

The entry portion of the database follows a logical workflow stemming from the database design. The workflow diagram is shown in Figure 2. The graphic was designed to aide the user in supplying data to the database. The user provides the data, going from left to right, stepping through each color. The graphic is an image map, so clicking on the "Mission" box in the red section would take the user to the data entry form to supply the high-level mission information. Next, the user would proceed to the orange box, which is used to provide mission specific station information. Any number of satellites or ground stations can be added for a given mission. Within this level, the user will be prompted to add antennas and sensors (satellites only). The yellow box has two hot spots image-mapped: one to relay satellites and one to earth stations. This is the section where a user can identify resources that the mission is using, but are not owned by the mission. These are referred to as "Shared Resources". This saves the user from supplying data that is

already in the database by allowing them to select from a drop-down option list of available shared resources.

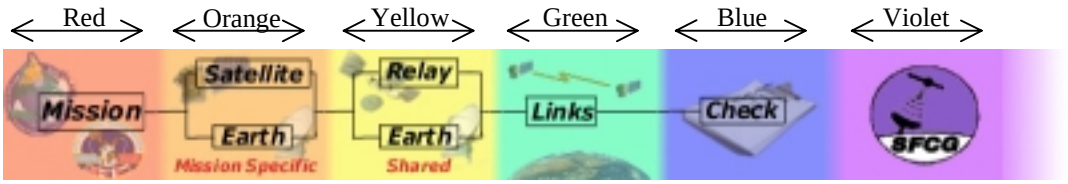

Figure 2: Data Entry Workflow Graphic

Once all stations are defined, the user proceeds to the green box to define the links. This involves first selecting transmitting and receiving antennas and then defining communications parameters. All required stations and antennas must have been defined before proceeding to the links. The reason for this is that the available antennas for defining the link are in a selection list that is built dynamically, based on the transmitting and receiving stations and antennas that have been defined for the mission. The last step the user performs on the workflow is in the blue box: check and submit for approval. The system has built in checks to ensure that defined elements are used, as well as system compatibility and boundary checking.

Data Entry

Entry Page Anatomy

There are up to five basic areas on the entry pages. Figure 3 depicts each of these partitions. The workflow is at the top of every page in the entry section (discussed in detail in the previous section). The next area down is the selection partition. This portion changes with the area clicked on in the workflow. The background color matches the color on the workflow to give users a quick visual indicator as to where they are in the process (Figure 3 shows the form for a satellite; therefore, the selection portion is orange). The drop-down selection box in this section shows all elements available, as well as the option of adding a new element. For the satellite, the selection box would contain the option of adding a new satellite to the mission or selecting from any of the satellites previously added.

The location partition of the page simply tells the user where they are in the process. This also allows the users to jump to any parent level in the tree. Clicking on the "Mission TEST" in "Current Location: Mission: TEST > Spacecraft: TEST" from Figure 3 would return the user to the mission entry form for the TEST mission. The next partition on the page is the form itself. This area may update dynamically as selections are made. The last partition, which may or may not appear, is for connected elements. This is used when the high level elements that are on the workflow have elements associated with them that need to be defined. For a user-defined satellite or ground station, this section includes options to add or modify existing sensors and/or antennas. The link form allows users to define the channel parameters.

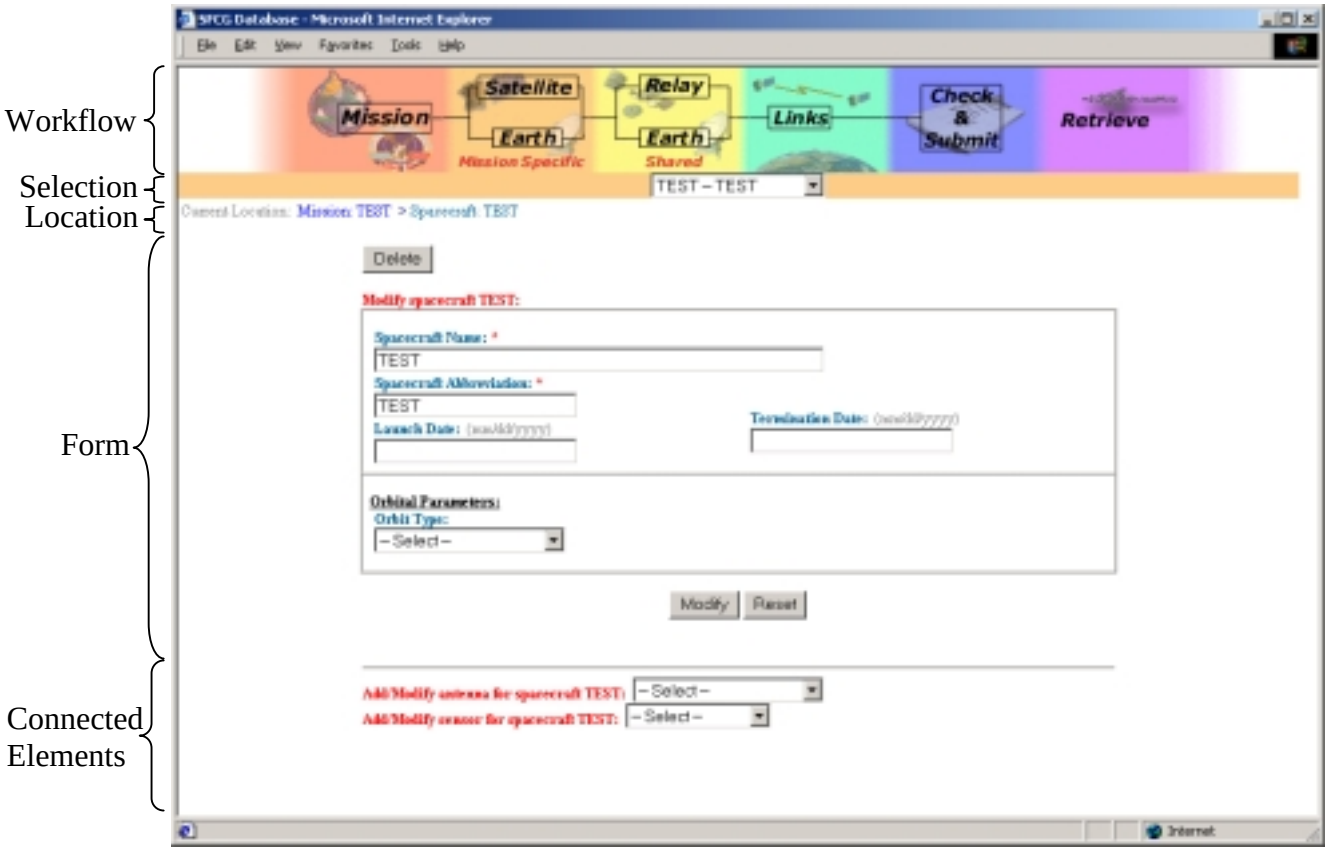

Figure 3: Entry page partitions

Step-by-Step

This section contains a summary of the process for adding or modifying a mission.

1. From the SFCGDB home page, click on "Mission Entry" in the left navigation frame or click on "Entry" in the bottom right-hand corner of the image map.
2. Enter the account user login and password. This will open a separate browser window. Initially the page only consists of the workflow graphic and the drop-down selection for the missions. The selection list is populated with all missions in the entry phase for the user's agency.
3. Select an existing mission or opt to add a new mission. The page is refreshed, now displaying the mission form.
4. Fill in all known information. Note that items with a red asterisk are required fields. In Figure 3, Spacecraft Name and Spacecraft Abbreviation are such fields. These must be filled in to properly structure the database. A user cannot proceed until all asterisked parameters have been supplied. Other parameters should be supplied as information is available, but a user can come back and add this information at a later time.
5. Proceed, repeating steps 3 and 4 for all elements. Below is the order a user is prompted to enter data.

a. Mission
b. Mission Specific Spacecraft
    i. Antennas
    ii. Sensors
c. Mission Specific Ground Stations
    i. Antennas
d. Shared Relay Satellite
e. Shared Ground Station
f. Link
    i. Channel

Information is not provided through the forms for shared resources. Instead, a user simply selects from the available resources by highlighting and clicking the right arrow to move the option to the selected box. An example of this window is shown in Figure 4. When all of the desired resources are selected the user proceeds using the workflow image-map.

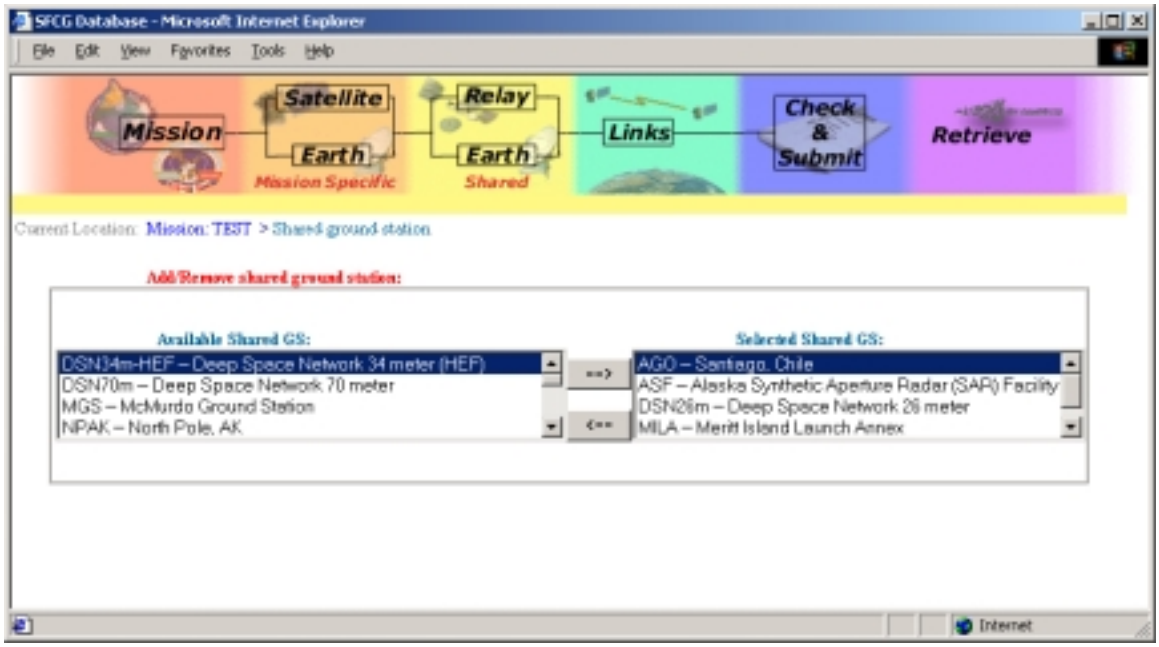

Figure 4: Shared resource selection

6. The last step is for the user to define the links. When a user clicks on the Links box in the workflow, the selection section contains a drop-down selection box. This box will allow users to edit any existing link or add a new link. If the user opts to add a new link, the link type must be identified: Uplink, Non-Broadcast Downlink, Broadcast Downlink, Forward Link, Return Link, and Space-To-Space Link. The required parameters are dependent on the link type. Selection boxes are filled based on the previously defined elements. For example, Figure 5 shows the form for an uplink. In this case, a ground station and associated antenna are selected as the transmitting elements. Conversely, a spacecraft and associated antenna are selected to receive.

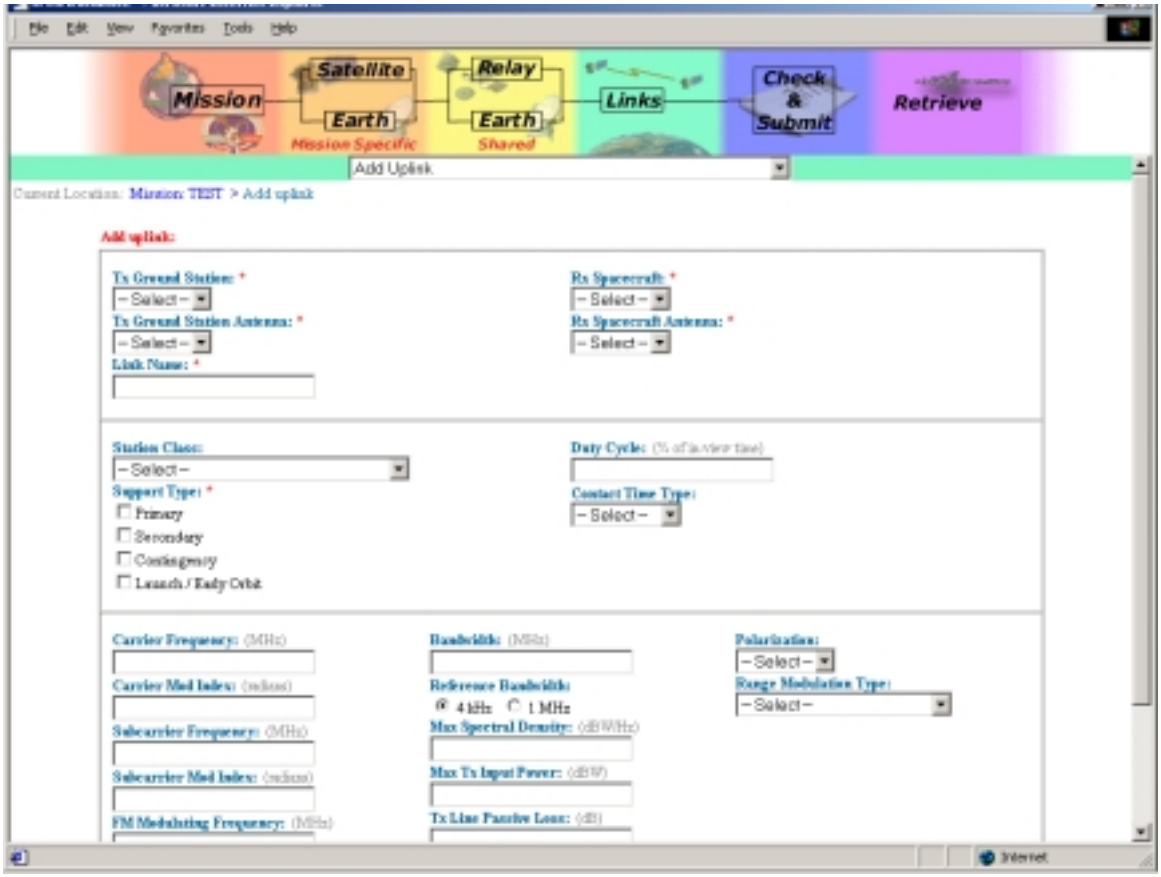

Figure 5: Uplink Entry Form

In the case of Forward and Return Links, currently the user is prompted for service information specific to NASA's Tracking and Data Relay Satellite System (TDRSS), since that is the only relay system in the database at this time. The user is also queried for various link communication parameters. Some link characteristics are defined once for the link and some are defined on a per channel basis.

7. When all of the data is entered, there are a series of checks that the application will run. These are discussed in the following section.

Mission Submittal

When all of the mission data is supplied, the user is ready to submit the mission. Up to this point, the mission has not been available for viewing by other agencies and is not displayed in the search portion of the site. Before making the data available, users should run a check on the data. This is done by clicking the check image-map. The application will perform a number of system checks, including: boundary checking, unused equipment or resources, and compatibility. Any items where the mission fails should be corrected before the mission is submitted.

Submitting the mission is actually a different function for the entry level and the approval level users. When an entry-level person submits a mission, an email is sent to the approval person to notify them that all of the data has been provided and the mission is

ready for review. Once the agency approval person has verified all of the mission data, they submit the data to the database. Only after the designated agency approval person verifies and submits the data is it available for viewing via the search tool provided.

Search

A user will need an account to search the database. Accounts can be set with only search permissions for those who will not be performing data entry. Users can proceed to the search area by using the navigation on the left hand side of the home page or clicking on the graphic "Search" text on the top of the page. There are two searches available: link search and sensor search.

The link search form has the following options as search criteria: circle around specified location, link type, orbit type, frequency range, agency, mission, and time frame. Figure 6 shows the link search form. Each criterion that is applied will further limit the search. Circle around specified location allows a user to select either a specified mission ground station or enter a specific longitude and latitude. In either case, the radius around the location needs to be supplied. This can be used to limit the search geographically. The link type allows the user to specify the direction of the link. Options are: Uplink, Downlink, Forward, Return, or Space-to-Space. The orbit type parameter allows the user to select one or more orbit type(s) for consideration: geo-synchronous, sun-synchronous, Lagrangian, deep space, or other non-synchronous. The frequency notation and display result are parameters that format the result of the search.

Both the link and sensor forms share these criteria: frequency range, agency, mission, and time frame. The frequency range criterion allows a user to enter a minimum and maximum frequency. The search engine compares these against the frequency ranges in the database. Both agency and mission selections provide the user the ability to limit the number of agencies or missions considered in the search. For the time frame parameter, the user can specify a starting and ending date. This is very important in mission model planning. The sensor form also offers the user the option to specify the sensor type: active, passive, or both.

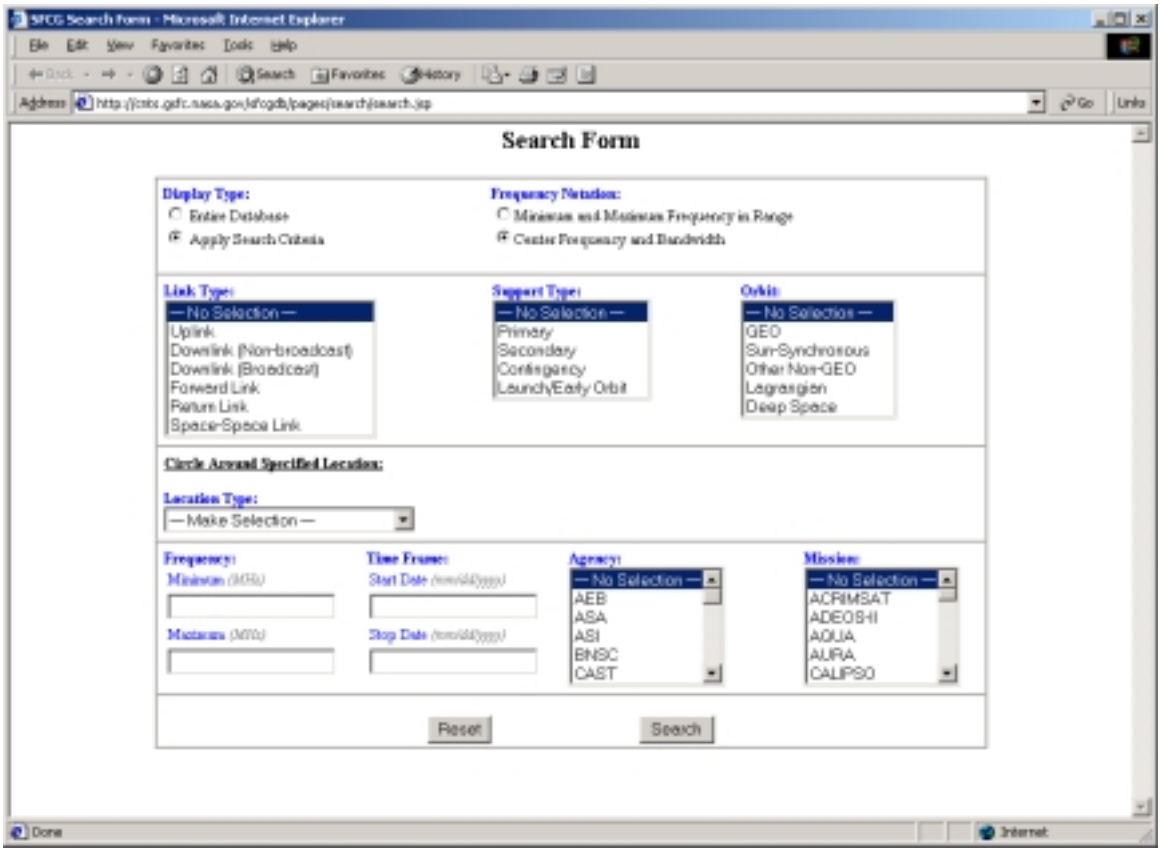

Figure 6: Link Search Form

The search will produce a summary table of high-level information. The user has the option to reorder the display by clicking on any of the column headers that are underlined. The user also has the option to view the data summary in Excel and MSWord formats in addition to the html web page shown in Figure 7.

Sensor Summary Table

4 Record(s) matched

Sensor Link Identifier	Mission	Agency	Center Frequency (MHz)	Bandwidth (MHz)	Sensor Type	Phenomenon Measured	Mission Start (yyyy-mm-dd)	Mission Stop (yyyy-mm-dd)
Test 1/1.2000	FAST	NASA GSFC	1.2000	12.0000	Active	Clouds, humidity, nitrous oxide	1996-08-21	
Test 2/1.3000	ICESAT	NASA GSFC	1.3000	13.0000	Passive	Chlorine oxide	2001-12-15	
Test 2/2.3000	ICESAT	NASA GSFC	2.3000	23.0000	Passive	Chlorine oxide	2001-12-15	
Test 2/3.3000	ICESAT	NASA GSFC	3.3000	33.0000	Passive	Chlorine oxide	2001-12-15	

Excel Format MSWord Format

Show Details Search Again

Figure 7: Sensor Summary Table Display

The left-most column contains the unique link identifier. Clicking on this link text will update the page to display the details of the selected link. The detailed display for the sensor is shown in Figure 8. The arrow buttons at the top of the page allow the user to view the details of other links contained in the summary table without having to go back to the summary each time. The buttons (from left to right) allow the user the go to the first entry in the list, the previous record, and the last record entry in the summary table.

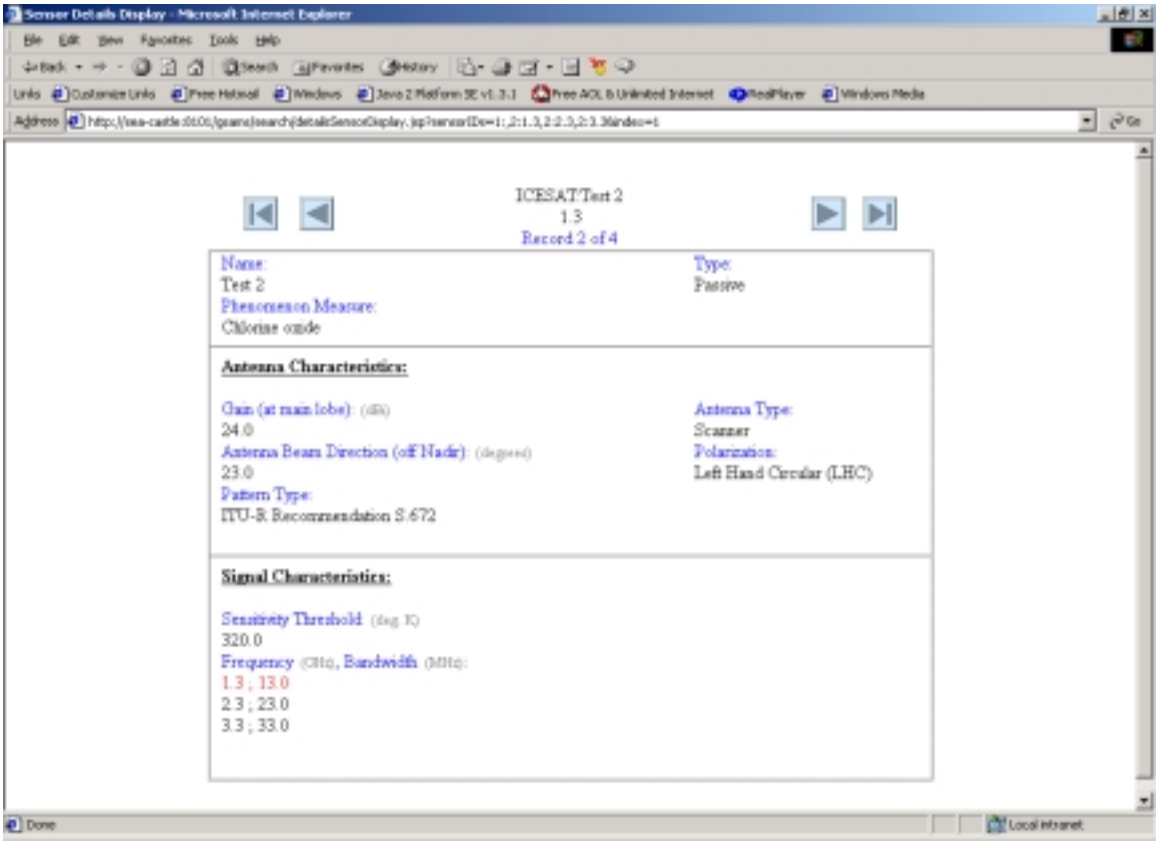

Figure 8: Sensor Search Detailed Display

Summary

This document should provide the user with enough guidance to begin entering mission data. There is a brief help section available on-line; it is accessible by clicking on "Help" in the left navigation panel. If there are further questions about data entry, or the site in general, please contact the appropriate person as listed on the contact page. For search and display options, please contact the person listed as responsible for "Site Functionality Questions/Problems" on the contact page.

Resolution A22-1R1

INTERSESSIONAL WORKING GROUP (IWG) ON TECHNICAL AND OPERATIONAL APPROACHES TO IMPROVE THE SPECTRUM UTILIZATION OF EARTH EXPLORATION SATELLITE SERVICES IN THE 8025 – 8400 MHZ BAND (IWG [X-BAND EES])

The SFCG,

CONSIDERING

a) that the 8025 – 8400 MHz Earth Exploration Satellite (EES) band is becoming congested due to growth both in the number of missions and the increase in the bandwidth requirements of some future Earth science missions;

b) that in addition to the missions by member agencies, missions by non-member entities operate in the 8025 – 8400 MHz Earth Exploration Satellite (EES) band;

c) that future wideband missions may use the Ka-band (25.5 – 27.0 GHz) where feasible, taking into account the availability in several agencies of on-board equipment, and the status of ground infrastructure development, in this band;

d) that there is a need to optimise the use of the band by existing and future missions;

e) that maintenance of a comprehensive database of missions operating in the 8025-8400 MHz band is required;

f) that there are multiple approaches that should be considered to enhance the spectrum utilization of the 8025-8400 MHz band

g) that early coordination among users can reduce the possibility of interference;

h) that an increasing number of EESS missions is likely to increase also the interference into the deep space band 8400 – 8450 MHz;

NOTING

that past workshops have been effective at involving non-member entities and progressing the work of the SFCG;

RESOLVES

1. that the IWG [X-Band EES] has the following terms of reference:

   to formulate a more rigorous and early coordination process involving member agencies and non-member entities;

   to consider the methods of maintenance, including access and updating, of

a comprehensive database (see Annex 2) of member and non-member missions operating in the 8025-8400 MHz band;

to formulate an X-band Workshop per the preliminary guidance given in Annex 1;

to review the adequacy of provisional SFCG Rec 14-3R5;

to provide the status and results of the above analyses to the SFCG-24;

2. that Thomas von Deak (NASA) is the chairman of the IWG [X-Band EES], and the members are:

ESA	-	E. Marelli
ESA	-	M. Otter
CNES	-	F. Cornet
NASA	-	B. Kaufman
NASA	-	R. Porter
NASA	-	J. Miller
ESA	-	J.-L. Gerner
JAXA	-	S. Fukuda
ESA	-	B. Rommen
RASA	-	M. Vasiliev
CSA	-	J. Chambers
ASI	-	L. Garramone
NASA	-	R. Taylor
NASA	-	T. Berman
ISRO	-	S. Sayeenathan
DLR	-	K. Ruf
NOAA	-	D. McGinnis
NASA	-	R. Cager
NASA	-	F. Manshadi
NASA	-	M. Sue

Preliminary Guidance to the SFCG IWG [X-BAND EES] regarding the formulation of an X-Band Workshop

X-Band Workshop formulation

1. Identify and involve key persons from the non-Government sector to participate with SFCG participants in the formation of the Workshop, including establishment of objectives and agenda.
2. Identify date, duration, and location of workshop (tentative date: Spring, 2005) *Decision by 31 January 2004*
3. Establish and distribute objectives and agenda of the workshop by 31 May 2004.
4. Establish a Steering Group comprised of SFCG members and non-SFCG entities by March 2004[1].

Tentative X-Band Workshop Objectives (SFCG perspective)

1. Identify and involve key persons from the non-Government sector to participate with SFCG participants in the formulation of an appropriate coordination function.
2. Provide briefing information on the roles of the ITU-R and SFCG.
3. Provide the latest database showing the usage of the band.
4. Provide the results of all analysis to date.
5. Identify methods for reducing costs associated with potential interference.
6. Identify methods for avoiding costs associated with real-time on-orbit coordination.
7. Formulation of a cost-effective coordination function that addresses the needs of both Governmental and non-Governmental users of the 8025-8400 MHz band.
8. Present appropriate maintenance and distribution mechanisms for the X-Band user/mission database.
9. Promotion of the development of EES systems that reflect spectrum conservation based on provisional SFCG Recommendation *Use of the 8025 - 8400 MHz Band by Earth Exploration Satellites*.
10. Identify the processes by which technical and/or operational recommendations can be approved to assure that all existing and future users are involved in their definition and equitably affected (ITU-R framework may be appropriate).
11. Review of current protection criteria in light of improved technologies.
12. Consider additional potential recommendations that would promote efficient usage by Earth Exploration-satellite service in the 8025-8400 MHz band.

[1] Tentatively an IWG meeting may be convened at the ITU in Geneva during the period March 15-17, 2004.

Annex 2 to Resolution [22-1R1]

Description of Information for Satellites using the band 8025-8400 MHz

1.Name of the mission*
2.Status (D= under development, C= under consideration, O**= in operation)*
3. Number of satellites*
4.Orbit type (LEO, LEO-sun synchronous, HEO, GSO)*
5.Required orbital parameters:

a) For all satellites:
- Orbital altitude (apogee and perigee)
- Inclination angle

b) In addition, for sun-synchronous orbits:
- Mean local time (MLT) with indication of whether it applies to either the ascending or descending node;
- The longitude on the surface of the Earth at the instant of time when the satellite crosses the equatorial plane in either the ascending or descending direction;
- Repeat time, or number of orbits required to repeat the ground track;

c) In addition, for non-sun-synchronous orbits:
- The right ascension of the ascending node (RAAN);
- Epoch time of the ascending node and the corresponding mean anomaly of the satellite in the orbit.

6. Total bandwidth used / expected to be used per satellite*
7. Satellite EIRP* and gain pattern if available, frequency(s), modulation type and symbol rate, emission filtering if known and whether the system meets SFCG Recommendation 21-2
8. Requirement for broadcast mode and associated power, antenna gain, bandwidth, and frequency*
9. Required Eb/No at the input to the demodulator of the Earth station receiver
10. Number of ground stations and geographic coordinates (latitude, longitude)*
11. Antenna gains* and reference patterns of ground stations and receiving system noise temperature
12. Minimum Earth station antenna elevation required
13. Expected launch date and lifetime*

* For planned systems under consideration or development these items constitute the minimum information set. If information is not available, a best estimate should be provided and identified as such.
** For existing missions, reference to entries in SFCG Database will be considered sufficient.

Resolution A23--1

SFCG MEMBER EMERITUS

The SFCG

Considering:

1. That there may be mutual benefit in encouraging former long-term SFCG participants to maintain an association with successor participants,

2. That value is seen in enabling retired long-term SFCG participants to retain a social cohesion with a view to voluntarily continuing an association with other current and retired SFCG participants,

Recognizing:

That the value of service by some members, in terms of years of participation and quality of contributions, exceeds the merit recognized in the award of the SFCG Silver Pin,

Resolves:

1. That Member Emeritus status be awarded to those retired participants who, during their active service within SFCG, have participated in at least 12 meetings and have been awarded, during their service, the SFCG Silver Pin,

Resolution A23-2

INTERSESSIONAL WORKING GROUP (IWG) ON TECHNICAL AND OPERATIONAL APPROACHES TO ADDRESS THE GLOBAL DEPLOYMENT OF ULTRA WIDE BAND DEVICES, IWG [UWB]

The SFCG,

CONSIDERING

a) that at least one administration has established rules permitting marketing of devices "incorporating ultra-wideband (UWB) technology" and several other administrations are in process of preparing their own rules for these applications;

b) that the rules established by one administration of the prior consideration are predicated on the ultra low power emission characteristics of the UWB devices currently addressed by those rules;

c) that it is expected that many administrations will permit the sale and use of broadband devices (in particular unlicensed devices) for communications, local area networks, and other such uses in the near future;

d) that there are strong market pressures for the development and deployment of ultra low power emission devices (ULPEDs), inclusive of UWB devices, based on the rules of the administration of considering a);

e) that the deployment of ULPEDs can raise the noise floor of frequency bands where EESS and SRS missions (both active and passive) operate;

f) that the increased noise floor caused by the deployment of ULPEDs may adversely affect the mission objectives of EESS and SRS (both active and passive) operations;

g) that study questions regarding the deployment and regulation of UWB devices are addressed under ITU-R Task Group 1/8;

h) that the administrations of many of the SFCG member agencies are likely to produce rules for the deployment of ULPEDs within those administration's borders and those same administrations are also likely to participate in ITU-R Task Group 1/8;

RESOLVES

1. that the SFCG establish an Intersessional Working Group Ultra Wideband (IWG [UWB]) for the Assessment of Broadband Devices to investigate, study, measure, and catalogue these devices and the environment in which they will be operated to determine whether such devices pose any threat or risk of interference to any systems or services of interest to SFCG member agencies.

2. that Warren Martin is the Chairman of the IWG [UWB] and the members are:

S. Sayeenathan	(ISRO)
R. Wolf	(EUMETSAT)
S. Fukuda	(JAXA)
F. Eng	(NOAA)
K. Ruf	(DLR)
C. Rivera	(NOAA)
C. Sham	(NASA)

D. McGinnis	(NOAA)
T. vonDeak	(NASA)
E. Marelli	(ESA)
B. Rommen	(ESA)
W. van Driel	(IUCAF)
G. Rochard	(ITWG)
J. Pla	(CNES)
R. Jacobsen	(CSIRO)
L. Vadillo	(INSA)
M. Vasiliev	(RASA)
U. Christ	(ESA)
F. Manshadi	(NASA)

IWG WORK PLAN

FIRST YEAR

1) Identify, determine, and catalogue important technical characteristics of UWB and other broadband devices, which are currently available or which will become available up to the next several years, and record that information in a form to be provided by the person leading this IWG. Such information includes, without limitation:

    a) Device's Name?
    b) Device's purpose?
    c) Manufacturer's name?
    d) Model Number.
    e) Device's Center Frequency?
    f) Upper and lower frequencies where the spectrum falls to 10 dB below the peak level?
    g) Spectral generation:
        i) Does a short-pulse or modulated carrier produce the spectrum?
        ii) If system is pulse based:
            (1) Is dithering used to vary pulse spacing?
            (2) If a modulated pulse, what type of modulation (e.g., amplitude, pulse-position, other)?
        iii) If system is carrier based,
            (1) Is a modulation applied?
            (2) What modulation method is employed?

2) Submit completed form to the IWG chairman.

3) Create database on web-site available to all parties and ensure data is current.

4) Identify, establish, and document existing and emerging guidelines, standards, and regulations that could establish the limits of interference from UWB devices in specific bands.

5) Perform noise floor measurements in the space science bands and establish the corresponding reference levels.

6) Prepare draft SFCG position for submission through Members' administrations to TG 1/8 relating to the use, deployment, and protection requirements of UWB and other broadband devices.

7) Report first year results to SFCG-24.

SECOND YEAR

1) Continue to update database.
2) Identify, establish, and document existing and emerging guidelines, standards, and regulations that could establish the limits of interference from UWB devices in specific bands.

3) Estimate number and density of UWB and other broadband devices identified during first year likely to be in the vicinity of systems used by SFCG member Agencies.

4) Compile SFCG member agencies' submissions regarding existing noise floor measurements in bands of interest.

5) Determine the impact to the reference noise floor established during the first year by mass deployment of UWB devices operating in bands of interest to SFCG member agencies.

6) Estimate likelihood that the required concentration of such devices to cause harmful interference would be present within the critical distance of an SFCG Agency system.

7) Continue to develop position regarding UWB and other broadband devices in order to obtain an SFCG consensus regarding such devices.

8) Report second year results to SFCG-25.

THIRD YEAR

1) Continue to update database.
2) Identify, establish, and document existing and emerging guidelines, standards, and regulations that could establish the limits of interference from UWB devices in specific bands.

3) Continue activities of year two.

Technical Resolutions

Resolution 5-9R1

PROTECTION OF FREQUENCY BANDS ALLOCATED TO PASSIVE SENSING AND RADIOASTRONOMY

The SFCG,

CONSIDERING

a) that certain frequency bands are restricted to use by the passive services, and that no emissions are permitted in these bands;

b) that it has happened at least once that a space research mission has involved emissions in one of these restricted bands;

c) that some planned space research missions intend to transmit in these restricted bands;

d) that in other bands the passive services share with other space and terrestrial services;

e) that radio astronomy is conducted terrestrially or in space and is especially susceptible to interference on account of the high sensitivity of the receiving equipment;

f) that emissions from artificial satellites can be especially harmful to radioastronomy because they may be in or near the main beam of the receiving antenna, and that therefore no frequency allocations have been made, which are shared between the RAS and space services in the space-to-Earth direction;

g) that there may be exceptional circumstances in which emissions from space in bands shared between radioastronomy and active services may be justified for technical or other reasons;

RESOLVES

1. that member agencies adopt a general policy of not conducting missions involving emissions from space in those bands allocated to the Radioastronomy Space Research (passive) and EES (passive) service;

2. that member agencies inform the IUCAF of proposals being considered for space projects involving emissions in bands also allocated for passive use, including details suitable for publication in regular bulletins of concerned scientific organizations;

3. that the scientific community be encouraged to submit relevant comments regarding the proposed emissions before frequency assignments are finalized;

4. that member agencies refrain from conducting missions that involve emissions in the bands restricted to the passive services.

Resolution 5-10R1

INTERFERENCE TO DATA COLLECTION SYSTEMS OPERATING IN THE 401-403 MHz FREQUENCY BAND ALLOCATED TO THE METEOROLOGICAL SATELLITE SERVICE AND THE EARTH EXPLORATION SATELLITE SERVICE

The SFCG,

CONSIDERING

a) that the current use of data collection systems is substantial and will grow considerably in the future;

b) that all member agencies that operate data collection systems have reported interference in the 401-403 MHz band;

c) that such interference is usually one of two types:

- interference due to spurious emissions, which affects a single channel or a group of channels,

- high power interference which affects the complete band and thus all channels;

d) that such interference has already disrupted the operation of data collection services and at times rendered the systems totally unusable;

e) that the interference could be due to other services allocated in the band such as meteorological aids and/or fixed/mobile terrestrial services;

f) that some interference could be due to other services such as radiolocation devices not allocated in the band;

g) the need to enable reliable, interference-free, operation of data collection systems;

h) the need to further identify interfering sources;

RESOLVES

1. that concerned member agencies continue monitoring of interference, and exchange information on the nature and technical characteristics of the observed interference;

2. that member agencies report to the ITU Radiocommunications Bureau (Space Services Department), via their respective administrations, cases of interference from sources not authorized to use the band.

Resolution 14-1R1

USE OF THE INTER-SATELLITE SERVICE (ISS) 23 GHZ BAND

The SFCG,

CONSIDERING

(a) that the SFCG agreed to support members proposed use of the 22.55-23.55 GHz and 25.25-27.5 GHz bands for Data Relay Satellite (DRS) forward and return link operations, respectively, by data relay satellites;

(b) that ITU-R SA.1019 recommends the use of the 22.55 - 23.55 GHz and 25.25 - 27.5 GHz band for forward and return links of data relay satellites;

(c) that the 23.12 - 23.55 GHz band segment has been identified by Space Network Interoperability Panel (SNIP) for inter-satellite service (ISS) links from geostationary DRS satellites to low orbiting user satellites giving due consideration to the radioastronomy allocations at 22.81-22.86 GHz and 23.07-23.12 GHz;

(d) that, although limited studies of the ISS links of one Mobile Satellite Service (LEO) (MSS (LEO)) system as currently designed indicate that this system may be compatible with certain planned DRS operations in the 23.12-23.55 GHz band, other MSS(LEO) systems may represent significant interference problems for the planned DRS's;

(e) that the 24.45 - 24.75 GHz, 32 - 33 GHz and 59 - 64 GHz bands are also allocated for ISS;

RESOLVES

that SFCG members urge their administrations to avoid using the band 22.55 - 23.55 GHz for ISS links other than for DRS systems, and only when necessary, to use the 22.55 - 22.81 GHz portion of this band for ISS links for non-DRS systems, thus ensuring compatibility between DRS systems, non-DRS systems and radioastronomy operations.

Resolution 14-3R1

MICROWAVE POWERED HIGH ALTITUDE RELAY PLATFORMS

The SFCG,

CONSIDERING

a) that microwave powered high altitude radio platforms are proposed to operate at altitudes up to 20 km;

b) that these platforms, which will be powered by the transmission of electro-magnetic energy from the surface of the Earth, require very high levels of power from the ground (>500 kW) to propel and operate the aircraft and associated electronic equipment;

c) that the system operators are contemplating such power transmission in bands allocated to the radiolocation service and ISM, which may be an inappropriate use of that service as presently defined;

d) that the radiated beam of power (EIRP >135 dBW) required to operate the platform may produce power density levels at orbital altitudes sufficient to cause physical damage to space-based active and passive sensors and other radio equipment, even when operating in frequency bands removed from the fundamental power transmission frequency;

e) that the radiated beam of power has the potential to cause high levels of out-of-band and harmonic emissions from intermodulation products resulting from the non-linear characateristics of the platform rectifying antenna (RECTENNA) used to convert RF energy to direct current energy to operate the platform;

f) that the platforms are intended to suppoort terrestrial radio services over a wide area (> 750,000 km2);

g) that such radio services may provide benefits in certain areas of low-to-medium density population distribution, but not without significant potential for harmful interference to existing terrestrial and space radio systems.

RESOLVES

1) that member agencies urge their respective administrations to take into account the following considerations during the licensing process for Microwave Powered High Altitude Relay Platform systems:

1.1) Interference to other radio services resulting from intermodulation products generated by the high power densities interacting with the non-linear characteristics of the RECTENNA;

1.2) interference and potential damage to avionics equipment on board aircraft that fly through or near the high power beam;

1.3) interfernce and potential damage to telecommunication equipment on satellites that traverse the high power beam;

1.4) potential physical damage to active and passive sensors on low orbiting satellites which traverse the high power beam;

1.5) the propriety of using allocations to the radiolocation service, as currently defined, for the purpose of transferring power to the aircraft.

Resolution 15-2R4

SUITABLE ALLOCATIONS FOR RADIOASTRONOMY OBSERVATIONS IN SPACE

The SFCG,

CONSIDERING

a) that radio astronomy observations can be conducted with terrestrial and space-based stations individually or in combination;

b) that space-based radio astronomy currently includes cosmic microwave background observations, very low-frequency, millimetre and sub-millimetre observations, which are either not accessible from ground-based observatories or need to use bandwidths far in excess of existing allocations;

c) that space-based radio astronomy also includes space VLBI observations which intend to use practically all bands allocated to the Radio Astronomy Service;

d) that protection criteria for space-based radio astronomy, which would take into account the specific characteristics of space-based observatories, have not yet been developed;

RESOLVES

1. that its member agencies recognize that space-based radio astronomy observations may be conducted in bands allocated to the Radioastronomy Service and/or to the Space Research Service (passive);

2. that the protection criteria given in Recommendation ITU-R RA.769-1 shall be considered as giving basic protection to space-based radio astronomy stations that use the radio astronomy service frequency bands.

Resolution 15-3

PROPOSAL FOR REALIGNMENT OF FREQUENCY ALLOCATIONS IN THE 32 GHz SPACE RESEARCH (DEEP SPACE) (SPACE-to-EARTH) BAND

The SFCG,

CONSIDERING

a) that the Space Research Service (deep space) use of the 31.8-32.3 GHz band is allocated on a Primary basis and the evolution and radio-technological improvements attendant to space research science in higher frequency bands is consistent with ITU-R principles;

b) that, to satisfy requirements, present and future deep space science missions rely heavily on the 31.8-32.3 GHz band for space-to-Earth links with improved performances available in terms of increased data transmission rates and reduced effects of interplanetary charged particles;

c) that signals received on Earth from spacecraft in deep space are inherently extremely weak and highly susceptible to interference of all kinds;

d) that Space Research sharing with many radio Services has been documented as feasible;

e) that Space Research sharing with the Inter-Satellite Service and with airborne elements of the Radionavigation Service has been documented as not feasible in ITU-R Recommendation SA.1016,

RESOLVES

1. that member agencies urge their administrations to review current allocations in the frequency range 31.8-32.3 GHz with a view to improving the sharing conditions between the Space Research Service (deep space) (space-to-Earth) and the other currently allocated Services;

2. that SFCG Recommendation 14-1 be used as the basis for calculating the interference effects to deep space Earth station receivers in this frequency range;

3. that member agencies encourage their administrations to consider revision of current allocations between 31.8-33.4 GHz for the Radionavigation Service and between 32.0-33.0 GHz for Inter-Satellite Service including the possibility of restricting ***aeronautical*** Radionavigation systems to the band 32.3-33.4 GHz and exclusion of the Inter-Satellite Service from the band 32.0-32.3 GHz.

Resolution 15-5R2

WIND PROFILER RADAR SYSTEMS IN THE BANDS NEAR 1000 MHz

The SFCG,

CONSIDERING

a) that 3 bands have been identified as possible candidates for use by wind profiler radars: 904 - 928 MHz, 1270 - 1295 MHz, 1300 - 1375 MHz;

b) that the frequency band 1215-1300 MHz is allocated on a primary basis to the Earth exploration-satellite (active) and space research (active) services with some limitation expressed in footnote S5.332;

c) that the frequency band 1215-1300 MHz is allocated on a primary basis to the radiolocation service;

d) that ITU Resolution 217 resolves to urge administrations to implement wind profiler radars as radiolocation service systems in the bands 904-928 MHz in Region 2 only, 1270-1295 MHz and 1300-1375 MHz, having due regard to the potential for incompatibility with other services;

e) that some studies have been completed which have shown that as few as twenty wind profiler radars operating in random locations throughout the United States and Canada would cause unacceptable degradation in the performance of active spaceborne sensors operating in this band;

f) that wind profiler radars are planned in significant numbers (approximately 150 in the US/Canada);

g) that other studies have come to different conclusions about the compatibility of the two systems;

RESOLVES

that member agencies should inform their respective administrations that in making assignments to wind profiler radars in the band 1270-1295 MHz, they should consider that the remote sensing by active sensors in the band 1215-1300 MHz could experience some limitations. Member agencies shall promote the use of either of the other 2 bands indicated in considering a) and d).

Resolution 16-1R3

SHARING BETWEEN DATA RELAY SATELLITE AND PROXIMITY LINK COMMUNICATION SYSTEMS AND HIGH POPULATION DENSITY POINT-TO-MULTIPOINT FIXED SYSTEMS IN THE VICINITY OF 26 GHz

The SFCG,

CONSIDERING

a) that a number of Administrations are considering the introduction of high population density point-to-multipoint systems in the band 25.25-27.5 GHz, currently allocated to, inter alia, the inter-satellite service;

b) that SFCG members are concerned with the potential for interference to inter-satellite service systems, including data relay satellite and proximity link operations, which may result from the introduction of high population density point-to-multipoint fixed systems at frequencies around 26 GHz;

c) that these point-to multipoint systems are characterised by dense concentration in urban areas producing high aggregate EIRP levels toward satellite receivers which may be in low Earth orbit or in geostationary orbit;

d) that studies indicate that high population density point-to-multipoint systems may cause unacceptable interference to satellite receivers at elevation angles as high as 50° in several cases;

e) that because of economic considerations, high population density point-to-multipoint systems will probably need to be licensed based on coordination using methods different from existing procedures,

RECOGNIZING

that Study Group 9 has developed Recommendation ITU-R F.1509 imposing e.i.r.p. density limits upon hub stations of high population density point-to-multipoint systems,

FURTHER RECOGNIZING

that subscriber stations in point-to-multipoint FS networks are governed by the provisions of Recommendation ITU-R F.1249,

RESOLVES

that space agencies study what practical procedures need to be developed to protect the space systems from unacceptable interference, taking into account:

- the aggregate EIRP from low and high population density point-to-multipoint fixed system transmitters at angles above the horizon;
- that the limits on point-to-multipoint FS networks in Recommendations ITU-R F.1509 and F.1249 were derived based upon compromise estimates of the future deployment densities for such FS networks.

Resolution 17-1R1

PROTECTION OF SPACE SCIENCE SERVICES FROM TERRESTRIAL SERVICE SYSTEMS IN THE BANDS 2025-2110 MHz AND 2200-2290 MHz

The SFCG,

CONSIDERING

a) that WARC-92 allocated the bands 2025-2110 MHz and 2200-2290 MHz to the space research, Earth exploration-satellite and space operation services (collectively, the space science services), on a co-primary basis with existing allocations to the fixed and mobile services;

b) that these international allocations were made in recognition of the critical reliance of space science systems on access to these bands, and the substantial capital investment in the ground-based and space-based infrastructure by the space agencies of countries representing between them more than 80% of the world's population;

c) that Resolution 211 (WARC-92) recognized the difficulty of sharing between certain types of mobile systems and the space science services and requested the CCIR to study the matter;

d) that RR S5.391 and Recommendation ITU-R SA.1154 stipulates the provisions required to protect space science services from the emissions of mobile service systems in this frequency range, indicates that sharing with certain low density mobile systems is feasible, and states that high population density mobile systems (such as PCS, GMCS, IMT-2000) cannot share these bands with space science systems;

e) that at WARC-92 sharing between the fixed service and the space science services was considered feasible based on long term successful experience with existing systems and their corresponding density within the shared bands;

f) that large numbers of fixed service systems have been displaced into these 2 GHz bands to accommodate new (mobile service) personal communication systems in adjacent bands;

g) that based on Resolution 113 (WARC-92), which anticipated the needs of fixed service systems to be accommodated in other bands, ITU-R has drawn up new channelisation plans in Recommendation ITU-R F.1098 which encompass the 2025-2110 MHz and 2200-2290 MHz bands;

h) that the investment in compatible fixed and mobile service systems in these bands in both developed and developing countries is significant;

i) that Recommendations ITU-R F.1147, F.1148, SA.1273, SA.1274, and SA.1275 stipulate the conditions necessary to ensure a stable long-term sharing environment between space science service systems and fixed service systems operating in these frequency bands;

j) that spacecraft of significant mass capable of surviving re-entry, must be controlled to ensure impact occurs in non-populated areas;

RECOGNIZING:

1) that all member space agencies of the SFCG rely heavily upon the availability of the 2025-2110 MHz and 2200-2290 MHz bands to conduct their Cat. A missions, including manned and unmanned missions, fundamental scientific research, observing both the Earth and space environments, and making an expanding contribution to the knowledge base of ecological conditions;

2) that the worldwide capital investment of public funds in the ground-based and space-based elements of the communication networks, the launch, tracking, telemetry, command and control facilities, necessary to support both manned and unmanned endeavors in space is in excess of US $ 70 billion, and is irreversibly dependent on access to these 2 GHz bands;

3) that many administrations are, *inter alia*, implementing revenue-producing methods of apportioning the frequency spectrum;

4) that deliberate, controlled de-orbiting of large mass spacecraft can best be executed relying on communications systems using frequency bands near 2 GHz which provide all-weather, reliable communications characteristics;

RESOLVES

1. that member agencies make their respective administrations aware of the difficulties in sharing with proposed terrestrial system implementations, which may vary from country to country, in the bands 2025-2110 MHz and 2200-2290 MHz;

2. that member agencies urge their respective administrations to take into account:

   a) the significant capital investment in both space science and compatible terrestrial service systems in the 2 GHz bands,

   b) the need for continued access to these frequency bands, by both developed and developing countries, well into the 21st century, and

c) the public safety aspects of the space agencies' responsibility which can be satisfied only through access to these bands.

3. that member agencies urge their respective administrations to take all these factors into account in balancing the public interest when trying to identify viable blocks of spectrum as revenue-producing allocations.

Resolution 18-5

SFCG SOFTWARE GUIDELINES

The SFCG,

CONSIDERING

a) that a standard operating and programming environment for SFCG software packages will significantly enhance user friendliness and shorten the time to become familiar with the programs;

b) that proper documentation is essential to install, run, and understand the SFCG software packages with a minimum of effort;

c) that quick access to and easy maintenance of the SFCG software packages is desirable in order to make modifications or provide latest updates to programs and data bases with minimum effort;

d) that help utilities and menu driven input/output sections contribute significantly to the user friendliness of a program;

e) that data exchange between various SFCG software programmes should be compatible in order to make optimum use of available information;

RECOGNIZING

that computer viruses can prevail through attached files of e-mail and software distributed on diskettes

RESOLVES

1. that member agencies ensure that software developed for distribution to other member agencies:

    1.1 is designed to run on well established and commonly used PC platforms, operating systems and applications;

    1.2 is supported by accompanying documentation related to its installation and usage, including a description of its basic structure and any underlying mathematical models or simulation methods used;

    1.3 is not encumbered with special licensing or cost implications to the users;

1.4 includes menu-driven input/output sections and on-screen help facilities;

1.5 includes the ability to review and edit inputs prior to programme execution;

1.6 provides that data used or generated by a programme be available in standard ASCII format in order that it is accessible by other programmes.

2. that member agencies screen data and files for computer viruses before distribution or after receipt and that it is incumbent on all SFCG members to immediately alert the originator of infected files and other SFCG members in order that appropriate urgent corrective action is taken.

SPACE FREQUENCY
COORDINATION GROUP

Resolution 19-1

EFFICIENT USE OF SPECTRUM IN THE 25.5 – 27 GHZ AND 37-38 GHZ BANDS

The SFCG,

CONSIDERING

a) that it is essential to recognize the need to migrate high symbol rate Space Science missions to higher frequency bands;

b) that the band 25.5 – 27 GHz is allocated inter alia to the Earth Exploration Satellite Service (EESS) and is planned for increasing use for near Earth high data rate applications for direct space-to-Earth links;

c) that the band 37 – 38 GHz is allocated inter alia to the Space Research Service and is planned for increasing use for Category A and Category B (including highly elliptical orbit high data rate applications) for direct space-to-Earth links;

d) that various candidate modulation techniques are currently under investigation and some of these techniques may substantially reduce bandwidth requirements;

e) that in accordance with Article S3.3 of the Radio Regulations which calls for both technical and economically justifiable measures for reducing unwanted emissions;

f) that in accordance with Article S3.9 of the Radio Regulations, “the bandwidth of emissions also be such as to ensure the most efficient utilization of the spectrum; in general, this requires that the bandwidth of emissions be kept at the lowest values which the state of the technique and the nature of the service permit”.

RESOLVES

that member agencies use bandwidth efficient modulation techniques whenever practicable for high data rate space-to-Earth applications in the 25.5 – 27 GHz band and the 37 – 38 GHz band.

SPACE FREQUENCY
COORDINATION GROUP

Resolution 19-3R1

SPECTRAL SEPARATION FOR IMT-2000 STATIONS OPERATING IN BANDS ADJACENT TO THE SPACE RESEARCH, EARTH – SPACE, SERVICE BAND 2025 – 2110 MHz

The SFCG,

CONSIDERING

a) that WARC-92 designated the 1885 – 2025 MHz and 2110 – 2200 MHz bands allocated with a primary status to the Mobile service for IMT-2000 and that subsequent WRCs confirmed this decision;

b) that the implementation of IMT-2000 is in active preparation and that its start of operations is foreseen for 2001/2002;

c) that adjacent radio frequency interference from IMT-2000 base and mobile stations into the Space Research service shall be in accordance with the protection criteria of Recommendation ITU-R SA.1154;

d) that the spectral separation of the nearest IMT-2000 channel center frequencies above and below the boundaries of the neighbouring space science service necessary to meet the protection criteria of Recommendation ITU-R SA.1154 is a function of the power spectral density mask of IMT-2000 transmitters;

e) that ITU-R WP8F is working on a recommendation referred to as Recommendation ITU-R IMT.[UNWANT] for the specification of unwanted emissions which may not be in compliance with Recommendation ITU-R SA.1154;

RESOLVES

that member agencies urge their administrations to support the development of Recommendation ITU-R IMT.[UNWANT] in a way to achieve compliance with Recommendation ITU-R SA.1154.

Resolution 19-6R1

EESS ACTIVE SENSING REQUIREMENTS above 100 GHz

The SFCG,

CONSIDERING

a) that active sensors onboard Earth Exploration Satellites are an increasingly important tool for many scientific and operational applications;

b) that new technology for such sensors is becoming available and will allow them to operate at frequencies above 100 GHz;

c) that WRC-2000 has allocated the band 130-134 GHz to EESS (active) with footnote **S5.LLL** indicated that this allocation is limited to the band 133.5-134 GHz;

d) that WRC-2000 has allocated the band 237.9-238 GHz to EESS (active) and SRS (active) for spaceborne cloud radars only through footnote **S5.NNN**;

e) that the use of a 500 MHz band by EESS(active) in the 133.5-134 GHz range will allow the operation of radar altimeters with a high horizontal and vertical resolution required to measure the thickness of snow and ice over land;

f) that the use of a band of 100 MHz by EESS(active) and SRS (active) in the 237.9-238 GHz range will allow the operation of cloud radars aimed at complementing the measurements made in the range 94-94.1 GHz by detecting thinner and higher-altitude clouds, characterized by a reflectivity of –40 dBZ;

g) that WRC-2000 Resolution 731 indicates in its *resolves* that a future competent conference should consider the results of ITU-R studies with a view to revising the Radio Regulations, as appropriate, in order to accommodate the emerging requirements of active services, taking into account the requirements of the passive services, in bands above 71 GHz;

h) that studies at lower frequencies have demonstrated that EESS(active) can share with the Radiolocation service.

RESOLVES

1. that member agencies urge their respective administration to give due consideration to the possibility of proposing new allocations to EESS(active) and SRS (active) under *resolves* of Resolution 731 (WRC-2000) as indicated in *considering g)*;

2. that these allocations should preferably be proposed in bands where the sharing constraints are minimal.

Resolution 19-7R2

USE OF THE 7750-7850 MHz BAND BY NON-GSO METEOROLOGICAL SATELLITES

The SFCG,

CONSIDERING

a) that sensors onboard Meteorological Satellites (Metsats) are an increasingly important tool for monitoring the Earth and its environment;

b) that such sensors are becoming more complex with resulting increased data rates;

c) that the ITU Radio Regulations allocate the band 7750-7850 MHz to Metsats in non-geostationary orbits on a primary basis with PFD limits as listed in Table S21-4 of the RR; and that this band will be the primary band for many years;

d) that Metsat operators are developing plans to use the band to transmit such vital meteorological and environmental data to a number of ground stations, including direct read-out and CDA stations;

e) that spectrum requirements of individual missions may exceed 50 MHz, thus limiting the possibility of segmentation as a means of interference avoidance;

f) that only conscientious frequency management of the 7750-7850 MHz band employing techniques such as timing of orbital insertion and on-orbit station keeping will satisfy the future requirements of numerous Metsat operators;

RESOLVES

1. that space agencies planning and operating Metsats develop procedures for efficient use of the 7750-7850 MHz band that allow interference-free reception of vital meteorological and environmental data;

2. that direct readout transmissions be turned-off during passes of CDA stations when in conflict with downlinks of stored mission data (data dump transmissions);

INVITES

Members planning MetSat transmissions in this band to develop among themselves operating schemes that permit interference-free reception of data, including the need to interrupt direct broadcast transmissions within the reception area of CDA stations (stored data dumps) in case of conflict.

Resolution 20-1R1

APPROPRIATE POWER FLUX DENSITY LIMITS AND COORDINATION DISTANCES TO PROTECT THE SPACE RESEARCH SERVICE (SRS) IN THE BAND 37 – 38 GHz

The SFCG,

CONSIDERING

a) that the band 37-38GHz is allocated to the SRS on a primary basis;

b) that the band 37.5-40.5 GHz is allocated to Fixed-Satellite Service (FSS) (space-to-Earth) on a primary basis;

c) that WRC-2000 identified the band 37–38 GHz, amongst others, for High Density applications of the Fixed Service (HDFS);

d) that aspects of frequency sharing between the SRS and other services in the band 37-38GHz are contained in Question ITU-R 211/7(1993);

e) that a review of the SRS data availability requirements, with a view to some relaxation, may result in a more compatible sharing environment;

f) that sharing studies between the SRS and the FSS are being conducted by ITU JRG 4A-7B;

g) that the band 37–38 GHz is planned to be used for Lunar, Planetary, S-VLBI, Earth-sun Lagrangian points and Near-Earth applications;

h) that more than 500 MHz may be needed for high data rate transmission system between the moon and the Earth;

i) that protection criteria for the SRS in the band 37-38GHz are contained in Recommendation ITU-R SA.1396;

j) that ITU-R studies indicate a high potential for interference from FSS systems to some SRS earth stations receiving very high data rates from the moon;

k) the current studies indicate that a PFD limit between –123 dBW/m^2/MHz for high angles of incidence and –126 dBW/m^2/MHz for low angles of incidence would adequately protect METS (Moon-Earth Transmission System) applications;

l) that in accordance with RR S21.16, the PFD limits for the SRS are –105 dB(W/m^2/MHz) at angles of incidence above 25° and -120 dB(W/m^2/MHz) for non-GSO SRS missions and –125 dB(W/m^2/MHz) for GSO SRS missions at angles of incidence below 5°;

m) that in accordance with RR S21.16, non-GSO FSS PFD limits are -105 dB(W/m^2/MHz) at angles of incidence above 25°and –120 dB(W/m^2/MHz) at angles of incidence below 5° and GSO FSS PFD limits are–105 dB(W/m^2/MHz) at angles of incidence above 25° and –127 dB(W/m^2/MHz) at angles of incidence below 5°;

n) that WRC-03 will consider agenda item 1.32 addressing technical and regulatory provisions concerning the band 37.5-43.5 GHz, in accordance with Res.128 (Rev.WRC-2000) and 84 (WRC-2000);

o) that WRC-03 will consider agenda item 1.12 including a review of all EESS and SRS allocations between 35 and 38 GHz;

p) that WRC-2000 adopted Res.75 (WRC-2000) addressing the development of the technical basis for determining the coordination area for coordination of a receiving earth station in the space research service (deep space) with transmitting stations of high-density systems in the fixed service in the 31.8-32.3 GHz and 37-38 GHz bands;

NOTING

that other types of SRS applications in the band 37.5-38 GHz may have additional protection requirements for FSS PFD limits which may have to be taken into account;

RESOLVES

1. that member agencies urge their administrations to support “no change” to the current PFD limits for the SRS in the band 37-38 GHz when considering modifications to the PFD limits for the FSS as contained in RR S21.16 under WRC-2003 agenda item 1.32;

2. that appropriate FSS PFD limits to adequately protect METS and some other SRS Earth stations in the band 37.5-38 GHz may range between -123 dBW/m^2/MHz for high angles of incidence and -126 dBW/m^2/MHz for low angles of incidence based on currently available study results;

3. that member agencies urge their administrations to support the development of appropriate FSS PFD limits to facilitate sharing between SRS earth stations and FSS satellites in the band 37.5-38 GHz as a consequential change under WRC-2003 agenda items 1.32 and 1.12;

4. that member agencies request their administrations to support the preparation of the technical basis for the determination of suitable coordination distances to protect SRS earth stations from HDFS interference in the band 37-38 GHz.

Resolution 20-2R2

OPTICAL COMMUNICATIONS

The SFCG,

CONSIDERING

a) that optical communication has been demonstrated on Earth-to-space, space-to-Earth and space-to-space paths;

b) that further optical communication technology demonstrations and operational missions are currently planned by several SFCG member agencies;

c) that optical communication is being considered for space communication in near-earth and deep space environments;

d) that the optical spectrum is of use to scientific and industrial purposes other than communication;

e) that use and sharing of the optical spectrum has not been thoroughly studied within the International Telecommunication Union Radiocommunication Sector (ITU-R);

f) that the ITU-R has approved Questions ITU-R 228/3 (propagation), ITU-R 264/4 (fixed-satellite and inter-satellite services), and ITU-R 235/7 (space science) addressing spectrum above 275 GHz without an upper frequency limit and ITU-R 228/1 (spectrum management) addressing the possibility and relevance of including in the Radio Regulations frequency bands above 3000 GHz;

g) that the Radio Regulations currently do not include definitions or nomenclature with respect to optical communication links;

h) that Resolution **86** (Rev. Marrakesh, 2002) of the Plenipotentiary Conference instructed World Radiocommunication Conference (WRC) 2003 and subsequent WRCs to review and update the advance publication, coordination, notification and recording procedures to ensure that these procedures, characteristics and appendices reflect the latest technologies;

i) that Resolution **118** (Marrakesh, 2002) of the Plenipotentiary Conference resolves that WRCs can include in agendas for future conferences, items relevant to spectrum regulation of frequencies above 3 000 GHz and take any appropriate measures, including revision of the relevant parts of the Radio Regulations;

j) that WRC 2003 adopted Resolution **950** (Geneva, 2003), which provides a precedent for the inclusion of details on systems which are not in allocated bands (i.e., 275 to 3000 GHz) in the Master International Frequency Register,

RESOLVES

1. that SFCG member agencies that are developing or are considering the use of optical communication systems are encouraged to contribute to the ITU-R studies;

2. that the characteristics of Member agency optical communications systems be maintained in a SFCG database;

3. that based on the experience gained from Resolves 2, SFCG members provide relevant technical data to the ITU-R;

4. that the SFCG, through IUCAF, bring to the attention of the International Astronomical Union (IAU) the proliferation of space-based optical communication technology.

Resolution 20-3

PROTECTION OF RNSS IN THE 1 559-1 610 MHZ BAND

The SFCG,

CONSIDERING

a) that as a result of WRC-2000, a new radionavigation-satellite service (RNSS) allocation for operation in the space-to-space direction has been created in the band;

b) that spaceborne receivers are routinely deployed which operate in this band;

c) that MSS GSO systems are being deployed in the adjacent 1 525-1 559 MHz band having high EIRP and may cause harmful interference to terrestrial RNSS systems operating in this band;

d) that RNSS terrestrial (safety of life) systems defined by Rec. ITU-R M.1477 are critical;

e) that protecting terrestrial RNSS service (safety-of-life) will also protect low earth orbiting satellite systems;

f) that measurement of MSS out-of-band spectral power flux density (SPFD) may be feasible and may be used to better determine the level of interference to RNSS systems;

RECOGNIZING

1) that all practical means should be taken to protect RNSS (space-to-Earth) in view of its safety-of-life applications;

2) that similarly, all practical means should be taken to protect RNSS space-to-space service for current and future spaceborne receivers operating in this service;

RESOLVES

1. to encourage SFCG member agencies to make entities responsible for aeronautical safety of life operations in their administrations aware of the possible harmful interference from these MSS GSO systems in anticipation that this will encourage appropriate steps be taken to protect RNSS from this interference;

2. to bring this matter to the attention of the International Civil Aviation Organization (ICAO);

3. to encourage measurements and studies of MSS interference to better understand the possible degradation to RNSS systems.

Resolution 21-1

FORMATION FLYING SYSTEMS

The SFCG

CONSIDERING

a) that the radio links between the spacecraft operating in a formation flying system are crucial to mission success;

b) that such radio links are used both for navigation purposes, in maintaining relative attitude and positions, and for distribution of data among spacecraft in a formation flying system;

c) that the appropriate and timely selection of frequency bands of these communication links may have a significant impact on mission resources;

RESOLVES

to continue to study mission characteristics and frequency band availability with a view to providing a list of optimal allocations that may be selected by mission planners for intersatellite communications and navigation.

(See also Recommendation 21-1)

Resolution 21-2R1

REQUIREMENTS, PERFORMANCE, AND PROTECTION CRITERIA FOR EESS (PASSIVE) SENSORS

The SFCG,

CONSIDERING

a) that due to the continuous technological and scientific development, the requirements, performance and protection criteria for EESS (passive) sensors must be periodically reviewed;

b) that the basic parameters related to requirements, performance and protection criteria for EESS (passive) sensors are contained in the ITU-R Recommendations SA.515, 1028, 1029 respectively;

c) that any revision to these Recommendations requires a large consensus and a coherent approach in the parameters definition across all the passive bands;

d) that three main categories of passive sensors can be identified for the use of these bands:

1. 3-dimensional vertical atmosphere sounders requiring very high data reliability and medium resolution over multiple channels,
2. Imaging radiometers requiring high data reliability, medium resolution, integration over relatively large bandwidth single channels,
3. Atmospheric limb sounders requiring medium data reliability at very high resolution over many small bandwidth channels.

e) that any performance requirement has to be based on known scientific requirements for the measurement; the data resolution and availability levels must therefore be scientifically meaningful with respect to the applications for which they are used (e.g. forecasting, surface observations and climate monitoring);

f) that the implementation and orbiting of instruments capable of achieving the performance requirements should be met within a 10-year timeframe;

g) that the data availability parameter currently applied for imaging radiometers (99%) is considered inadequate for several applications associated to those measurements;

h) that the resulting values in these Recommendations will not be applied retro-actively;

RESOLVES

that Member Agencies submit to the SFCG contributions to update the values contained in Table 1, with a view to future updating of the ITU-R Recommendations listed in considering b).

TABLE 1

Performance criteria for satellite passive remote sensing

Frequency Band[6] (GHz)	Total BW required (MHz)	Reference BW (MHz)		Required ΔT_e (K)	Data availability (%)[3]	Scan Mode N, L[4]
1.370-1.400s, 1.400-1.427P	100	27		0.05	99.9	N
2.640-2.655s, 2.655-2.690s, 2.690-2.700P	45	10		0.1	99.9	N
4.200-4.400s, 4.950-4.990s	200	200		0.3/0.05*	99.9	N
6.425-7.250	200	200		0.3/0.05*	99.9	N
10.60-10.68p, 10.68-10.70P	100	100		1.0/0.1*	99.9	N
15.200-15.350s, 15.350-15.400P	200	50		0.1	99.9	N
18.600-18.800p	200	200		1.0/0.1*	95/99.9*	N
21.200-21.400p	200	100		0.2/0.05*	99/99.9*	N
22.210-22.500p	300	100		0.4/0.05*	99/99.9*	N
23.600-24.000P	400	200		0.05	99.99	N
31.30-31.50P, 31.50-31.80p	500	200		0.2/0.05*	99.99	N
36.000-37.000p	1 000	100		1.0/0.1*	99.9	N
50.200-50.400P	200	200		0.05	99.99	N
52.60-54.25P, 54.25-59.30p	6 700[1]	100		0.3/0.05*	99.99	N
86.00-92.00P	6 000	100		0.05	99.99	N
100.0-102.0P	2 000	10		0.005	99	L
109.5-111.8P	2 000	10		0.005	99	L
114.25-116.00P	1 750	10		0.005	99	L
115.25-116.00P 116.00-122.25p	7000[1]	200/10[5]		0.05/0.005[5]	99.99/99[5]	N, L
148.5-151.5P	3 000	500/10[5] 200		0.1/0.005[5]	99.99/99[5]	N, L

155.5-158.5p[2]	3 000	200		0.1	99.99	N
164.0-167.0P	3 000[1]	200/10[5]		0.1/0.005[5]	99.99/99[5]	N, L
174.8-182.0p, 182.0-185.0P, 185.0-190.0p, 190.0-191.8P	17 000[1]	200/10[5]		0.1/0.005[5]	99.99/99[5]	N, L
200.0-209.0P	9 000[1]	3		0.005	99	L
226.0-231.5P	5 500	200/3[5]		0. 2/0.005[5]	99.99/99[5]	N, L
235.0-238.0p	3 000	3		0.005	99	L
250.0-252.0P	2 000	3		0.005	99	L
275.0-277.0	2 000[1]	3		0.005	99	L
294.0-306.0	12 000[1]	200/3[5]		0.2/0.005[5]	99.99/99[5]	N, L
316.0-334.0	18 000[1]	200/3[5]		0.3/0.005[5]	99.99/99[5]	N, L
342.0-349.0	7 000[1]	200/3[5]		0.3/0.005[5]	99.99/99[5]	N, L
363.0-365.0	2 000	3		0.005	99	L
371.0-389.0	18 000[1]	200		0.3	99.99	N
416.0-434.0	18 000[1]	200		0.4	99.99	N
442.0-444.0	2 000[1]	200/3[5]		0.4/0.005[5]	99.99/99[5]	N, L
496.0-506.0	10 000[1]	200/3[5]		0.5/0.005[5]	99.99/99[5]	N, L
546.0-568.0	22 000[1]	200/3[5]		0.5/0.005[5]	99.99/99[5]	N, L
624.0-629.0	5 000[1]	3		0.005	99	L
634.0-654.0	20 000[1]	200/3[5]		0.5/0.005[5]	99.99/99[5]	N, L
659.0-661.0	2 000	3		0.005	99	L
684.0-692.0	8 000[1]	3		0.005	99	L
730.0-732.0	2 000[1]	3		0.005	99	L
851.0-853.0	2 000	3		0.005	99	L
951.0-956.0	5 000[1]	3		0.005	99	L

(1) This bandwidth is occupied by multiple channels.

(2) This band is needed until 2018 to accommodate existing and planned sensors.

(3) Data availability is the percentage of area or time for which accurate data is available for a specific sensor measurement area or sensor measurement time. For a 99.99% data availability, the measurement area is a square on the Earth of 2,000,000 km^2, unless otherwise justified; for a 99.9% data availability, the measurement area is a square on the Earth of 10,000,000 km^2, unless otherwise justified; for a 99% data availability, the measurement time is 24 hours, unless otherwise justified .

(4) N = Nadir; Nadir scan modes concentrate on sounding or viewing the Earth's surface at angles near Nadir. The scan terminates at the Earth's surface and weighting functions peak from the surface to the top of the atmosphere. L = Limb; Limb scan modes view the atmosphere "on edge" and terminate in space rather than at the surface, and accordingly are weighted zero at the surface and maximum at the tangent point height. Nadir-scanning sounders have superior horizontal resolution; limb sounders have superior vertical resolution.

(5) Second number for microwave limb sounding applications

(6) P = Primary allocation, shared only with passive services (5.340); p = primary allocation, shared with active services, and s = secondary allocation

* First number for sharing conditions circa 2003; second number for scientific requirements that are technically achievable by sensors within the next 10 years

Resolution 21-3R1

PROTECTION OF EESS (PASSIVE) SENSORS FROM ULTRA WIDEBAND DEVICE EMISSIONS

The SFCG

CONSIDERING

a) that passive microwave sensors on board spacecraft are an increasingly important tool for monitoring the Earth's environment;

b) that certain frequency bands are restricted to use by the passive services only and RR 5.340 stipulates that all emissions are prohibited in these bands;

c) that other frequency bands are allocated to the passive services and are shared with some active services;

d) that the passive sensing instruments by their nature are very sensitive to any emissions within the sensor band and operate by integrating a very low signal over time across a relatively large bandwidth (tens to hundreds of MHz);

e) that any emissions that raise the noise floor in bands allocated to Earth exploration-satellite (passive) service may constitute interference to the passive sensors using those bands;

f) that Ultra Wideband (UWB) devices are based on emerging technologies using very narrow pulses that generates very wide bandwidth (greater than 25 % of the center frequency or greater than 1.5 GHz), but typically at low power levels;

g) that studies have shown that the aggregate effect and the extreme wideband nature of such devices may cause interference in frequency bands allocated to passive remote sensing;

h) that UWB technology enables a wide assortment of applications such as through-the-wall imaging, ground-penetrating radars, collision-avoidance radars as well as other communications and security applications;

i) that some administrations are examining potential rules for the operation of UWB devices on a license-exempt basis;

RECOGNIZING

1. that the automotive industry has identified the band 22-29 GHz for implementation of UWB vehicular short-range radars;

2. that the band 23.6-24 GHz is part of a set of unique critical bands that are essential for numerical weather prediction and climate monitoring and is protected by RR 5.340;

3. that all studies have shown that UWB vehicular short-range radars and passive sensors operating in the 23.6-24 GHz band are incompatible, and all studies have resulted in negative margins in excess of 10 dB;

4. that the deployment of UWB devices may also impact other services in the EESS / Meteorological community, such as EESS (active), Search and Rescue, Metaids.

RESOLVES

1. that member agencies work within their administrations to ensure that UWB devices avoid emissions in bands exclusively allocated to passive services;

2. that member agencies work within their administrations to ensure that UWB devices avoid generating harmful emissions in the other bands allocated to passive sensors.

3. that member agencies continue to study the possible impact of the introduction of UWB devices into bands allocated to EESS (passive).

Resolution 23-1

SFCG OBJECTIVES FOR WORLD RADIOCOMMUNICATION CONFERENCES

The SFCG,

CONSIDERING

a) that its member agencies are vitally interested in achieving changes to the ITU Radio Regulations (RR) in order to enhance future space science system operations;

b) that changes to the RR can only be accomplished at World Radiocommunication Conferences (WRCs);

c) that on the agendas of all of these WRCs, items of interest to SFCG member agencies may be included;

d) that it is essential for SFCG member agencies to coordinate their conference preparations and to provide the necessary rationale for their requirements in order to achieve the desired results at WRCs;

RESOLVES

1. that consideration of SFCG WRC Objectives for the next and subsequent competent conferences identified in Annex 1 is vital for member agencies;

2. that, in preparation for WRCs, Annex 1 shall be up-dated in the light of conference agendas and evolving Objectives;

3. that Annex 2 shall list items of interest to SFCG members for consideration at a future conference, but not yet sufficiently mature for inclusion in Annex 1.

4. that member agencies will urge their administrations to make proposals to competent WRCs which satisfy these Objectives.

Annex 1 to SFCG Resolution 23-1

SFCG WRC-07 Objectives

Introduction

These are the objectives of SFCG members relative to the space science services on the agenda of the 2007 World Radio Communication Conference (WRC-07). The contents may be used by SFCG members to inform their Administrations, and to facilitate conference preparation and WRC consideration.

The presentation is organized to align with Agenda for the WRC-07 as presented in Resolution 802 [COM7/A] (WRC-03). Not all of the items in that agenda are of interest to the SFCG and therefore only those specific agenda items, relating to SFCG issues, are discussed herein.

SFCG promotes the use of space-based passive sensors to provide vital ecological and environmental data that is unobtainable by any other means. Such passive sensors depend for their successful operation on frequency bands that are defined by the physical laws of the atmosphere.

SFCG also promotes spectrum efficiency and recognizes the need for and the value of sharing frequency bands between more than one radio service, in cases where mutually agreed sharing and protection criteria have been established based on the results of ITU-R studies.

However, in frequency bands allocated to the Earth exploration-satellite (passive) service, where sharing with active systems has been shown to be not feasible, the SFCG holds the view that such active systems should not be implemented, and would support any review by administrations that might lead to a reduction in the number of such infeasible sharing situations in the Table of Frequency Allocations.

Agenda Item 1.2 "to consider allocations and regulatory issues related to the Earth exploration-satellite (passive) service, space research (passive) service and the meteorological satellite service in accordance with Resolutions 746 [COM7/8] (WRC-03) and 742 [COM5/3] (WRC-03)"

Resolution 746 [COM7/8] resolves 1 calls for sharing analyses between geostationary meteorological satellites operating in the space-to-Earth direction and the fixed, fixed-satellite and mobile services in the band 18-18.4 GHz to

define appropriate sharing criteria with a view to extending the current 18.1-18.3 GHz geostationary meteorological satellites allocation in the space-to-Earth direction to 300 MHz of contiguous spectrum. This will satisfy the requirement for the transmission of data from high resolution sensors on the next generation geostationary meteorological satellites, which will be launched in the time-frame 2015-2020.

SFCG Objective

SFCG supports this expansion of the current 18 GHz allocation for transmission of high rate data from geostationary meteorological satellites. SFCG members are encouraged to support these studies and their discussions within SFCG and via contributions to and participation in ITU-R Working Party 7B.

Resolution 746 [COM7/8] resolves 2 calls for sharing analyses between the EESS (passive) and the SRS (passive) and the fixed and mobile services in the band 10.6-10.68 GHz to determine appropriate sharing criteria. The EESS (passive) operating in the band 10.6-10.68 GHz may experience harmful interference from the emissions of systems of active services. The band 10.6-10.68 GHz is of primary interest for the measurement of rain, snow, sea state, ocean wind and soil moisture.

SFCG Objective

SFCG supports the protection of the passive services from the active services in the 10.6-10.68 GHz band. SFCG members are encouraged to support these studies and their discussions within SFCG and via contributions to and participation in ITU-R Working Party 7C.

Resolution 742 [COM 5/3] calls for sharing studies between the passive services and the fixed and mobile services in the band 36-37 GHz in order to define appropriate sharing criteria. EESS (passive) systems may experience harmful interference if a high density of fixed or mobile service stations is deployed in the band 36-37 GHz.

SFCG Objective

SFCG supports the protection of EESS (passive) systems and encourages its members to carefully consider any deployment of fixed or mobile service stations in the 36-37 GHz band within their Administrations. SGCG members are encouraged to support sharing studies and their discussions within SFCG and via contributions to and participation in ITU-R Working Party 7C.

Agenda Item 1.3 "in accordance with Resolution 747 [COM7/9] (WRC-03), consider upgrading the radiolocation service to primary allocation status in the bands 9 000-9 200 MHz and 9 300-9 500 MHz and extending by up to 200 MHz the existing primary allocations to the Earth exploration-satellite service (active) and the space research service (active) in the band 9 500-9 800 MHz without placing undue constraint on the services to which the bands are allocated"

Resolution 747 [COM7/9] calls for the technical characteristics, protection criteria, and other factors of radiolocation, radionavigation, EESS (active) and space research (active) systems that ensure compatible operations in the band 9 300-9 500 MHz and the study of the compatibility between terrestrial radars of the radiolocation and radionavigation services, and spaceborne radars of the Earth exploration-satellite and space research services in the band 9 300-9 500 MHz. In the event that sharing studies in the 9 300-9 500 MHz band lead to unsatisfactory conclusions which do not fully satisfy the requirement for an increase by up to 200 MHz of contiguous spectrum for EESS (active) and space research (active) services, additional sharing studies in the alternative frequency range 9 800-10 000 MHz are to be performed.

SFCG Objective

SFCG supports the increase in the current 9 GHz allocation to the EES (active) and SRS (active). SFCG members are encouraged to support these studies and their discussions within SFCG and via contributions to and participation in ITU-R Working Parties 7C and 8B.

Agenda Item 1.4 "to consider frequency-related matters for the future development of IMT-2000 and systems beyond IMT-2000 taking into account of the results of ITU-R studies in accordance with Resolution 228 (Rev.WRC-03)"

Any allocation to the IMT-2000 systems in bands already allocated to the meteorological aids, meteorological-satellite, Earth exploration-satellite, and space research services could pose a threat to those services.

SFCG Objective

The SFCG objective is to protect space science services allocations that may be considered for allocation to IMT-2000 and future systems, and support suppression of Resolution 228 (Rev. WRC-03). It is recommended that SFCG

members participate in and contribute to the preparation of CPM text, either directly or through their administrations, to ensure that the bands of interest to SFCG members, in particular the 2025 - 2110 MHz, 2200 – 2290 MHz bands and the 2290 – 2300 MHz bands, are not considered suitable and available to satisfy the requirements of IMT-2000 and systems beyond IMT-2000. And, in addition, that the provisions regarding the use of the 2110 – 2120 MHz band are not further eroded to accommodate the future requirements of IMT-2000 and systems beyond IMT-2000. SFCG members are also encouraged to review the results of these studies as documented by ITU-R Working Party 8F and to offer comments to Working Party 8F through Study Group 7.

Agenda Item 1.5 "to consider spectrum requirements and possible additional spectrum allocations for aeronautical telecommand and high bit-rate aeronautical telemetry, in accordance with Resolution 230 [COM7/5] (WRC-03)"

Resolution 230 [COM7/5] (WRC-03) calls for additional allocations between 3 and 30 GHz for wideband aeronautical telemetry and associated telecommand. The impacts to existing allocations to meteorological aids, meteorological-satellite, Earth exploration-satellite, and space research need to be considered as new allocations to wideband aeronautical telemetry and associated telecommand are pursued.

SFCG Objective

The SFCG objective is to protect existing space science services allocations and to support the studies that may lead to additional allocations in the 3 to 30 GHz band for aeronautical telecommand and high bit-rate aeronautical telemetry, which may also be used during atmospheric testing by space agencies. SFCG members are encouraged to support these studies and their discussions within SFCG and via contributions to and participation in ITU-R Working Party 8B.

Agenda Item 1.6 "to consider additional allocations for the aeronautical mobile (R) service in parts of the bands between 108 MHz and 6 GHz, in accordance with Resolution 414 [COM7/6] (WRC-03) and, to study current satellite frequency allocations, that will support the modernization of civil aviation telecommunication systems, taking into account Resolution 415 [COM7/7] (WRC-03)"

Resolution 414 [COM7/6] (WRC-03) calls for a review of bands allocated to aeronautical systems in the frequency range between 108 MHz and 6 GHz, and to determine whether additional allocations to the aeronautical mobile (R) service are required. The band 5 091-5 150 MHz is of particular interest.

Existing allocations to meteorological aids, meteorological-satellite, Earth exploration-satellite, and space research need to be taken into account during the studies of possible new allocations to the aeronautical mobile service.

SFCG Objective

The SFCG objective is to protect existing space science services allocations in the 108 MHz and 6 GHz bands. SFCG members are encouraged to review studies within SFCG and contribute to and participate in ITU-R Working Party 8B.

Agenda Item 1.7 "to consider the results of ITU-R studies regarding sharing between the mobile-satellite service and the space research service (passive) in the band 1 668-1 668.4 MHz, and between the mobile-satellite service and the mobile service in the band 1 668.4-1 675 MHz in accordance with Resolution 744 [COM5/12] (WRC-03)"

Resolution 744 [COM5/12] calls for studies relating to provisions to protect space research (passive) space stations from harmful interference from mobile earth stations in the band 1 668-1 668.4 MHz.

SFCG Objective

SFCG supports the protection of the space research allocation in the band 1668-1668.4 MHz. SFCG members are encouraged to support these studies and their discussions within SFCG and via contributions to and participation in ITU-R Working Parties 7C and 8D.

Agenda Item 1.8 "to consider the results of ITU-R studies on technical sharing and regulatory provisions for the application of high altitude platform stations operating in the bands 27.5-28.35 GHz and 31-31.3 GHz in response to Resolution 145 [COM5/17] (WRC-03), and for high altitude platform stations operating in the bands 47.2-47.5 GHz and 47.9-48.2 GHz in response to Resolution 122 (Rev.WRC-03)"

Resolution 145 [COM5/17] (WRC-2003) calls for technical sharing criteria or high altitude platform stations (HAPS) system design conditions to ensure that HAPS applications in the fixed service operate successfully on a non-harmful interference, non-protected basis in the bands 27.5-28.35 GHz and 31-31.3 GHz. The 31.3-31.8 GHz band is allocated to the radio astronomy, Earth exploration-satellite (passive) and space research (passive) services. WRC-03 amended No. 5.543A to specify signal levels that would protect satellite passive services and radio astronomy stations in the band 31.3-31.8 GHz.

HAPS unwanted emission limits as given in footnote 5.543A may have to be revised in light of modifications to ITU-R SA.1290 (see also AI 1.20).

SFCG Objective

SFCG supports the need for protection of the 31.3-31.8 allocation to the radio astronomy, Earth exploration-satellite (passive) and space research (passive) services. SFCG members will review the results of the HAPS studies as documented by Working Party 4-9S, and participate in Working Parties 7C, 7D and 4-9S as necessary to ensure that the passive space science services are protected.

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Agenda item 1.17 "to consider the results of ITU-R studies on compatibility between the fixed-satellite service and other services around 1.4 GHz, in accordance with Resolution 745 [COM5/14] (WRC-03)"

Resolution 745 [COM5/14] (WRC-03) calls for studies, including the measurement of emissions from equipment that would be employed in operational systems, to validate that the systems meet all requirements for the protection of passive services in the band 1 400-1 427 MHz from unwanted emissions from FSS feeder links for non-GSO satellite systems in the MSS with service links operating below 1 GHz, and to study the power flux-density (pfd) values required to protect sensors of the EESS (passive) operating in the band 1 400-1 427 MHz. Acceptable emission levels have already been identified in Working Party 7C.

SFCG Objective

SFCG supports the protection of the passive services in the band 1400-1427 MHz. SFCG recognizes the need for studies of adequate unwanted emission level specifications as well as the required bandpass rejection capability of sensor filters. SFCG members are encouraged to support these studies and their discussions within SFCG and via contributions to and participation in ITU-R Working Parties 7C, 7D and 8D.

Agenda item 1.18 "to review pfd limits in the band 17.7-19.7 GHz for satellite systems using highly inclined orbits, in accordance with Resolution 141 [COM4/23] (WRC-03)"

Resolution 141 [COM4/23] (WRC-03) calls for studies to determine whether the current pfd limits for non-GSO systems in the FSS in Article 21 are adequate to protect the fixed service in the 17.7-19.7 GHz band from non-geostationary systems without unduly constraining the use of these non-GSO FSS systems, and to determine whether there are technical and operational measures in the band 17.7-19.7 GHz that could be implemented in the fixed service to mitigate

interference from FSS space stations. The band 18.1-18.3 GHz is allocated to the meteorological-satellite service (space-to-Earth) on a primary basis, limited to geostationary satellites and in accordance with the provisions of Article 21, Table 21-4, under footnote 5.519. The band 18.6-18.8 MHz is allocated to EESS (passive) and SRS (passive).

SFCG Objective

SFCG supports the protection of these existing science service allocations. SFCG members are encouraged to monitor these non-GSO FSS system studies and their discussions within SFCG and via contributions to and participation in ITU-R Working Parties 7C and 4-9S.

Agenda item 1.20 "to consider the results of studies, and proposals for regulatory measures regarding the protection of the Earth exploration-satellite service (passive) from unwanted emissions of active services in accordance with Resolution 738 [COM4/14] (WRC-03)"

Resolution 738 [COM4/14] (WRC-03) calls for studies on the compatibility analyses between EESS (passive) and the corresponding active services in certain bands listed below with a view to updating Recommendation ITU-R SM.1633 or developing additional Recommendations.

EESS (passive) band	Active service band	Active service
1 400-1 427 MHz	1 350-1 400 MHz	Fixed service (FS) Mobile service (MS) Radiolocation service
1 400-1 427 MHz	1 427-1 429 MHz	FS, MS (except aeronautical mobile service) and space research service (Earth-to-space)
1 400-1 427 MHz	1 429-1 452 MHz	FS and MS
23.6-24 GHz	22.55-23.55 GHz	Inter-satellite service
31.3-31.5 GHz	30-31 GHz	FSS (Earth-to-space)
50.2-50.4 GHz[1]	50.4-51.4 GHz[1]	FSS (Earth-to-space)[1]
50.2-50.4 GHz[1]	47.2-50.2 GHz (Regions 2 and 3) 49.44-50.2 GHz[1] (Region 1)	FSS[1]

[1] Studies in this band must take into account No. **5.340.1** of the Radio Regulations.

According to Recommendation ITU-R SM.1633, the EESS (passive) in the band 52.6-54.25 GHz can be protected if the unwanted emissions of fixed-service systems operating in the band 51.4-52.6 GHz do not exceed –33 dBW in a 100 MHz reference bandwidth in the band 52.6-54.25 GHz. The results of Rec. ITU-R SM.1633 were based on the use of values obtained from Rec. ITU-R

SA.1029-1 which have been superceded by Rec. ITU-R SA.1029-2. This will require that the Rec. ITU-R SM.1633 annexes pertaining to EESS will need to be revised and the corresponding results re-examined.

SFCG Objective

SFCG supports the protection of these EESS (passive) allocations. SFCG members are encouraged to participate in these studies and their discussions within SFCG and via contributions to and participation in ITU-R Working Party 7C and Task Group 1/9 In addition, SFCG members are encouraged to consider contributions to Working Party 7C in bands other than those listed in Resolution 738 for possible development of joint ITU-R Recommendations with the affected active services.

Agenda item 7.1 "to consider and approve the Report of the Director of the Radiocommunication Bureau on inconsistencies encountered in the application of the Radio Regulations, and action in response to Res. 80 (WRC-2000)"

Resolution 951 [COM7/2] (WRC-03) calls for studies to be carried out by ITU-R to examine the effectiveness, appropriateness and impact of the Radio Regulations, with respect to the evolution of existing, emerging and future applications, systems and technologies, and to identify options for improvements in the Radio Regulations.

SFCG Objective

SFCG supports the opportunity to improve the Radio Regulations. SFCG members are encouraged to participate in these studies and their discussions within SFCG and via contributions to and participation in ITU-R Study Groups 7 and 1.

Annex 2 to SFCG Resolution 23-1-1

Items of interest to SFCG members for consideration at a future conference

The items of interest to SFCG members for consideration at a future conference are listed here. The presentation is organized to align with Agenda for the WRC-10 as presented in ITU-R Resolution 803 [COM7/B] (WRC-03). Not all of the items in that agenda are of interest to the SFCG and therefore only those specific agenda items, relating to SFCG issues, are presented herein.

Agenda item 2.2 "to consider frequency allocations between 275 GHz and 3 000 GHz taking into account the result of ITU-R studies in accordance with Resolution 950 [COM7/1] (WRC-03)"

Agenda item 2.7 "to consider the progress of ITU-R studies concerning the technical and regulatory issues relative to the fixed service in the 81-86 and 92-100 GHz frequency bands, taking into account Resolutions 731 (WRC-2000) and 732 (WRC-2000)"

Agenda item 2.8 "to consider the progress of the ITU-R studies concerning the development and regulatory requirements of terrestrial wireless interactive multimedia applications, in accordance with Recommendation 951 [COM7/2] (WRC-03) and to take any appropriate action on this subject"

Other items of interest to SFCG which are not currently proposed for any WRC agenda include:

- To review ITU-R footnote 5.332 and 5.335A with respect of the frequency band 1 215-1 260 MHz and 1260-1300 MHz concerning the Earth exploration-satellite (active) service and other services

- Upgrade from secondary to primary the allocation to EESS (active) in the band 24.05-24.25 GHz

- Make primary allocations to the space research (passive) service below 10 GHz, including the following bands:
  - 322 - 328.6 MHz
  - 1660-1660.5 MHz
  - [1668.4 - 1670 MHz]
  - 4950 - 5000 MHz

- Review ITU-R footnotes 5.469A, 5.476A, 5.498A, 5.501B and 5.513A, which affect active sensor operations in the following bands
    - 8550 – 8650 MHz
    - 9500 – 9800 MHz
    - 13.25 – 13.75 GHz
    - 17.2 – 17.3 GHz

- To highlight the importance and restrictions imposed on the 1544-1545 MHz band under ITU-R footnote 5.356 for safety and distress communications by modifying the Table of Frequency Allocations of the ITU Radio Regulations.

- The SFCG should advocate the introduction of a change to the Table of Frequency Allocations precluding the operation of aeronautical mobile transmissions in the band 37-38 GHz, to improve the sharing situation between the mobile service and the space research service. A similar effort is underway in ITU-R Working Party 9D to protect stations in the fixed service by excluding emissions from aeronautical mobile stations in bands above 37 GHz.

- Review the need for ITU-R footnotes 5.536A and 5.536B appended to the allocations to the space science services in the 25.25-27.5 GHz band.

Resolution 23-2

USE OF SYNTHETIC APERTURE RADARS IN THE BAND 5250-5570 MHz

The SFCG

CONSIDERING

a) that synthetic aperture radars on board spacecraft are an increasingly important tool for radar imaging of the Earth's surface;

b) that the C-band (near 5 GHz) is one of the most important bands for radar imaging;

c) that the band 5250 – 5570 MHz is allocated to the Earth exploration-satellite service (active) and space research service (active) on a primary basis;

d) that WRC-03 decided to allocate the bands 5250 – 5350 MHz and 5470 – 5725 MHz to the mobile service in the bands for implementation of wireless access systems, including RLANs;

e) that WRC-03 decided to allocate the band 5250 – 5350 to the fixed service for fixed wireless access (FWA) applications in certain administrations in ITU Region 3;

f) that WRC-03 decided to upgrade the allocation to the radiolocation service from secondary to primary in the band 5350 – 5650 MHz;

g) that operation by active sensors in bands allocated to the radiolocation, radionavigation and aeronautical radionavigation services has proven to be feasible both from theoretical studies and from many years of operational experience;

h) that studies have shown that outdoor usage of some wireless access systems operating in the mobile service can cause interference to narrowband spaceborne SARs in the band 5250-5350 MHz;

i) that while WRC-03 decided that operation of wireless access systems in the mobile service in the band 5250-5350 MHz should be predominantly indoor, outdoor operation of some systems would still be possible;

RESOLVES

1. that member agencies support regulatory actions within their administrations that limit wireless access systems in the band 5250 – 5350 MHz to indoor use only, to the maximum extent practicable in order to fully protect the use of this band for narrowband sensors;

2. that member agencies perform additional studies to verify the impact on EESS (active) sensors from the outdoor operation of wireless access systems in the bands 5250 – 5350 and 5470 – 5570 MHz and report the results to the SFCG;

3. that member agencies report any instances of interference in the bands 5250 – 5350 and 5470 – 5570 MHz to the SFCG;

4. that member agencies identify mitigation techniques to protect EESS (active) sensors from possible interference in the band 5250-5350 and 5470-5570 MHz bands and report such techniques to the SFCG.

Resolution 23-3

USE OF THE ALLOCATION FOR EESS (ACTIVE) IN THE BAND 432-438 MHz

The SFCG

CONSIDERING

a) that the need for monitoring forests was emphasized at the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro, 1992;

b) that there is a large scientific interest for using active sensors to map spatial distribution and dynamics of forest biomass, as well as to map and measure the depth of Antarctic ice and properties of arid and semi-arid regions;

c) that these radars must operate at frequencies below 500 MHz in order to penetrate dense vegetation and the Earth's surface;

d) that, in order to address this need, WRC-03 decided to allocate the band 432 – 438 MHz to the Earth exploration-satellite (EES) service (active) on a secondary basis;

e) that among the allocated services in the 432 – 438 MHz portion of the spectrum are radiolocation, amateur, fixed and mobile;

f) that the band 433.75 – 434.25 MHz is used by space operations service (Earth-to-space) for launch command and destruct communications in the French Overseas Departments in Region 2, and in India, France and Brazil as given in RR 5.281, and that other administrations also use narrow frequency bands within this frequency range for the same purpose;

g) that there is a potential for unacceptable interference from some spaceborne synthetic aperture radars to terrestrial space object tracking radars operating in the band 420 - 450 MHz;

h) that Recommendation ITU-R SA.1260-1 provides the technical and operational constraints on the use of spaceborne active sensors within the 420 – 470 MHz frequency range to facilitate sharing with other services allocated in this frequency range;

i) that, in order to protect the allocated services in the band 432 – 438 MHz, RR 5.279A

incorporates Recommendation ITU-R SA.1260-1 by reference;

j) that the radio astronomy allocation in the 406.1 – 410 MHz needs to be protected from potential unwanted emissions from active sensors operating in the Earth exploration-satellite service (active) secondary allocation in the band 432-438 MHz;

RECOGNIZING

1) that limiting the geographical areas of interest to EESS missions using this allocation (e.g. Amazonian rain forest, arid and semi-arid regions, the Antarctic) will help to minimize interference to other services allocated in this band;

2) that all objectives of the identified missions will be campaign oriented, i.e. they will be concentrating on a specific region for limited pre-determined periods (e.g. 1 month) and will not be transmitting in regions which are not of interest during those specific periods;

3) that avoidance of transmissions when in line of sight of terrestrial space object tracking radars may be necessary to avoid mutual interference between the spaceborne active sensors and the terrestrial space object tracking radars;

4) that the EES (active) service is obligated to protect launch vehicle range safety command operations where harmful interference, even for very short period of time, into launch vehicle telecommand receivers could endanger the safety of life and property;

5) that the free and open availability of advanced operational schedule information on each and every campaign would facilitate the protection of the existing allocated services in the 432 – 438 MHz band;

6) that at WRC-03, the SFCG has agreed to make such information freely available on its website and to keep such information up-to-date;

RESOLVES

1) that the SFCG will provide the free and open means for member agencies to make advanced operational schedule and sensor geographic area of coverage information available and up-to-date, via the official SFCG Web Site;

2) that member agencies submit such operational schedule and sensor geographic area of coverage information on intended spaceborne active sensing missions and their associated campaigns that will use the secondary allocation in the 432 – 438 MHz band to the SFCG Web Coordinator;

3) that member agencies with active missions and campaigns keep such operational schedule information up-to-date;

4) that member agencies use the coordination procedure given in the Annex to ensure the

protection of launch command and destruct communications;

5) that the SFCG address the concerns of the radio astronomy community with respect to potential unwanted emissions from active sensors operating in the 432 – 438 MHz band into the 406.1 – 410 MHz radio astronomy band.

ANNEX

Coordination Procedure for EESS (active) in the 432-438 MHz band with Space Operation Service Activities

This coordination activity shall be carried out as follows:

1. The Space agency responsible for the operation of EESS (active) sensor (EESS Agency) shall provide the information via SFCG Website (http://www.sfcgonline.org) sufficiently in advance of the launch of the satellite. This information will include:

    - contact point
    - satellite orbital data
    - sensor actual characteristics
    - scheduled launch date
    - planned schedule of operation
    - number of campaigns planned in an year
    - geographical areas to covered in each campaign
    - duration of operation of sensor over each region

2. When an EESS (active) campaign is planned, the space agency responsible for the operation of the EESS (active) sensor shall provide the following via the SFCG website:

    - Duration and schedule of the campaign
    - Geographical area to be covered

3. The Space agency carrying out the Space operation service activities (Space Operation Agency) shall examine the information given in 1 and 2 above. If the planned time period and the region of operation of the active sensor overlap that of the space operation service, Space Operation Agency shall inform the EESS Agency to switch off the EESS active sensor over the specific geographical region starting at a specific date.

4. The EESS Agency shall inform the Space Operation Agency that it has received this request and provide confirmation for this action.

5. Before the launch or during any time of the operation of EESS active sensor, if there is any change in the planned operation of EESS active sensor (in terms of time and duration of operation and area of operation), EESS Agency shall provide this information.

6. Space Operation Agency shall reexamine this information and provide its findings.

7. After the launch operations have been completed, the Space Operation Agency which has requested the EESS Agency to switch off the active sensor shall inform the EESS Agency of the end of the launch

operations and the ability for the EESS Agency to resume its sensor operations.

8. During any stage of this coordination, the EESS Agency and Space Operation Agency ensure the availability of their designated contact persons.

Resolution 23-4

EXPANSION OF THE EXISTING 18.1-18.3 GHz METEOROLOGICAL SATELLITE SERVICE ALLOCATION

The SFCG

CONSIDERING

a) that sensors onboard Geostationary Meteorological Satellites (Metsats) are an increasingly important tool for monitoring the Earth and its environment;

b) that Metsat operators are developing plans for the third generation of geostationary Metsats that will operate sensors with higher spatial and temporal resolution, including microwave sensors, producing much higher data rates than present geostationary Metsat sensors;

c) that this vital meteorological and environmental data collected by such new sensors will likely require bandwidths exceeding 200 MHz for transmission to a very limited number of CDA ground stations;

d) that the ITU Radio Regulations allocate, via RR **5.519**, the band 18.1-18.3 GHz to Metsats in geostationary orbits on a primary basis with PFD limits as listed in Table 21-4 of the RR;

e) that the present allocation is insufficient to allow for transmission of such anticipated future higher data rates and an expansion by 100 MHz will be required;

f) that to allow for timely implementation of the third generation Metsats, it will be necessary to decide on radio frequency plans by 2007 at the latest;

g) that WRC-03 placed on the agenda for WRC-07 consideration of expanding the current Meteorological Satellite Service allocation in FN 5.519 by 100 MHz (agenda item 1.2);

RESOLVES

that space agencies planning and operating geostationary Metsats conduct the necessary technical compatibility studies concerning all affected services and submit the results to ITU-R;

INVITES

Members planning third generation geostationary Metsat systems to actively participate in ITU-R sharing and compatibility studies between the meteorological satellite service and the fixed, mobile and fixed satellite services and in the relevant WRC preparatory processes with an objective to gaining approval at WRC-07 for expansion of the Meteorological Satellite Service allocation given in FN 5.519 by 100 MHz.

Resolution 23-5

Protection of Future Radio Astronomy Observatories in the Shielded Zone of the Moon

The SFCG,

CONSIDERING

a) that the shielded zone of the Moon (SZM) provides a unique location for radio astronomy observations shielded from interfering man-made radio transmissions on Earth or from satellites in geostationary orbit;
b) that actual planning of a radio astronomy observatory in the SZM may not happen earlier than 2050, and that its system parameters may differ considerably from those of telescopes currently in use;
c) that a radio astronomy observatory in the SZM will need to be designed and operated with the objective of minimizing its susceptibility to man-made emissions, including those from missions to the Earth-Sun L2 point and deep-space missions, especially those to Mars;
d) that such an observatory will make observations in frequency bands in addition to frequency allocations made to the radio astronomy service by the ITU;
e) that other missions, like the ones to Mars or to the Sun-Earth L2 point, will also require large bandwidths for data transfer back to Earth or to a relay satellite, and that they will inevitably illuminate the SZM under certain geometrical conditions;
f) that by the time a radio observatory in the SZM becomes operational, optical links for broadband data transfer are expected to be available and in use;

RECOGNIZING

i) that the SZM is defined in Article 22, Section V, of the ITU Radio Regulations;
ii) that emissions in the SZM are prohibited for all but the space research (active) and space operations services in order to protect radio astronomy observations;
iii) that Article 22, Section V, of the ITU Radio Regulations does not include emissions from deep space missions and from missions to the Sun-Earth L2 point;
iv) that ITU-R has adopted Recommendation ITU-R RA.479-4 on the protection of frequencies for radio astronomical measurements in the SZM;
v) that Resolution B15 of the International Astronomical Union addresses the issue of frequency bands to be used for radiocommunications in the SZM,

RESOLVES

1. that members planning a radio astronomy observatory in the shielded zone of the Moon inform the SFCG of such plans;

2. that members, through the SFCG, work together with IUCAF to exchange planning information for missions to the Sun-Earth L2 point and for deep space missions, specifically to Mars;
3. that members, through the SFCG, work together with IUCAF to study issues of compatibility of a radio astronomy observatory in the shielded zone of the Moon, as well as the requirements of deep-space missions and Sun-Earth L2 point missions, with the view to developing an SFCG Recommendation.

Recommendations

Recommendation 4-3R3

UTILIZATION OF THE 2 GHz BANDS FOR SPACE OPERATION

The SFCG,

CONSIDERING

a) that the frequency bands 2025-2110 and 2200-2290 MHz are shared co-equally by the Space Research, Space Operation, and Earth Exploration Satellite services;

b) that bands allocated to the Space Operation service may be used for space tracking, space telemetry, and space telecommand (TTC) by other space services;

c) that the definition of the Space Operation service (S1.23) postulates that these TTC activities by other space services normally be carried out in their service bands;

d) that the bands 2025-2110 and 2200-2290 MHz, which are already now densely occupied, are of prime importance for space science missions of SFCG agencies and will remain so for many years to come as no comparable alternative frequency allocations are available;

RECOMMENDS

1. that geostationary space systems of space services other than the space science services which are designed to operate in mission bands other than 2025 - 2110 and 2200 - 2290 MHz, but which utilize TTC systems within these bands, shall limit the use of such TTC systems to a single frequency pair per satellite and to launch, orbit insertion and emergency operations.

2. that TTC systems for geostationary satellites of space services other than the space science services should be designed in accordance with the general characteristics as contained in Table 1 below.

3. that non-geostationary satellites of services other than the space science services avoid using these bands for TTC

TABLE I.

Typical System Parameters for Space Operations of Geostationary Satellites at 2 GHz

MODE	SYSTEM PARAMETERS	
Reception at earth stations	Telemetry bandwidth	100 kHz
	Tracking bandwidth	400 kHz
	G/T earth station	20 dB/K
Transmissions from earth stations	Telecommand bandwidth	100 kHz
	Tracking bandwidth	400 kHz
	EIRP, earth station	65 dBW

Recommendation 5-1R5

USE OF THE 8450-8500 MHz BAND FOR SPACE RESEARCH, CATEGORY A[1][2]

The SFCG,

CONSIDERING

a) that the Radio Regulations permit the use of the 8450 - 8500 MHz band for Category A and Category B[3] space research missions;

b) that the band is one of only three worldwide primary allocations for space research service below 40 GHz;

c) that the band, because of crowding at 2200-2290 MHz, is particularly suitable for missions to the Libration point for example;

d) that the 8400 - 8450 MHz band is allocated for and restricted to Category B missions;

e) that the 14.0 - 15.35 GHz and 37 to 38 GHz bands have been identified as appropriate for Category A missions requiring wide (greater than 10 MHz) bandwidth;

RECOMMENDS

1. that the 8450 - 8500 MHz band be used for Category A missions requiring an occupied bandwidth of up to 10 MHz per mission and having technical requirements that are best satisfied in the band;

[1] Category A missions are those having an altitude above the Earth of less than $2 \cdot 10^6$ km.

[2] CCSDS has adopted a similar Recommendation.

[3] Category B missions are deep space missions. Deep space is defined by the RR as distances from the Earth equal to or greater than $2 \cdot 10^6$ km.

2. that the band be used in particular for the mission to the Libration points with bandwidth requirements up to 10 MHz;

3. that utmost care be taken in the assignment of frequencies to these missions in order to make optimum use of the limited bandwidth available to Cat. A missions, and that the maximum bandwidth, postulated in “recommends 1” above, of 10 MHz per mission be strictly respected;

4. that the 8450 - 8500 MHz not be used for Category B missions.

Recommendation 6-1R4

INTERFERENCE FROM SPACE-TO-SPACE LINKS BETWEEN NON-GEOSTATIONARY SATELLITES TO OTHER SPACE SYSTEMS IN THE 2025 X 2110 and 2200 X 2290 MHz BANDS

The SFCG,

CONSIDERING

a) that space-to-space transmissions between two or more non-geostationary satellites shall not impose any constraints on other space systems (ITU RR 750A);

b) that the planned increase in the number of space-to-space links between non-geostationary satellites will nevertheless raise the likelihood of harmful interference;

RECOMMENDS

that the power spectral density of space-to-space links between non-geostationary satellites be reduced by using appropriate modulation techniques and channel coding in accordance with CCSDS recommendations, in order to reduce the potential for harmful interference to space-to-Earth, Earth-to-space, and other space-to-space transmissions, involving at least one geostationary satellite.

Recommendation 6-2R1

TRANSPONDER TURNAROUND FREQUENCY RATIOS

FOR SPACE RESEARCH, CATEGORY A[1][2]

The SFCG,

CONSIDERING

a) that many space missions require coherency between the Earth-to-space and space-to-Earth links in order to provide accurate doppler frequency shift and range delay measurements;

b) that a turnaround frequency ratio must be defined for those missions which require coherency;

c) that standardized transponder turnaround frequency ratios are necessary for one agency's spacecraft to be supported by another agency's earth stations;

d) that care should be exercised in the selection of the numbers comprising the turnaround frequency ratios;

e) that transponder turnaround frequency ratios have previously been defined and used extensively and successfully in the 2,7, and 8 GHz Category A frequency bands,

RECOMMENDS

1. that, for Category A missions, SFCG member agencies utilize the transponder turnaround frequency ratios listed in Table 1.

[1] Category A missions are those having an altitude above the Earth of less than $2 \exists 10^6$ km.

[2] CCSDS has adopted a similar Recommendation.

TABLE I - Turnaround frequency ratios for Category A[1] missions

Frequency ratio	Allocated band (MHz)	Nominal[2] available band (MHz)	Allocated band (MHz)	Nominal[2] available band (MHz)
E-S/S-E 221/240 749/880 221/900 765/240	*E - S* 2025 - 2110 7190 - 7235 2025 - 2110 7190 - 7235	*E - S* 2025 - 2110 7190 - 7235 **2075 - 2087** 7190 - 7235	*S - E*w200 - 2290 8450 - 8500 8450 - 8500 2200 - 2290	*S - E* 2200 - 2290 8450 - 8500 8450 - 8500 **2256 - 2270**
E-S/E-S 221/765	*E - S* 2025 - 2110	*E - S* **2077 - 2090**	*E - S* 7190 - 7235	*E - S* 7190 - 7235
S-E/S-E 240/900	*S - E* 2200 - 2290	*S - E* **2253 - 2267**	*S - E* 8450 - 8500	*S - E* 8450 - 8500

(1) Category A missions are those whose distance from the Earth is less than $2 \exists 10^6$ km.

(2) The nominal available band for a particular direction is determined by the frequency ratio and the width of the allocated band for the other direction. The figures listed are approximate. For some frequency ratios, for example 221/900, the width of the nominal available band in one of the directions will be less than the allocation width in that direction. These cases are shown in bold face type.

Recommendation 7-1R4

TRANSPONDER TURNAROUND FREQUENCY RATIOS AND RADIO FREQUENCY CHANNEL PLANS FOR SPACE RESEARCH, CATEGORY B [1][2]

The SFCG,

CONSIDERING

a) that accurate frequency references are required on many space missions to obtain Doppler frequency and range information;

b) that standardized turnaround ratios are especially necessary for those missions which require support of earth stations operated by two or more member agencies;

c) that care should be exercised in the selection of the numerical factors which make up the turnaround frequency ratios;

d) that certain turnaround frequency ratios have been used extensively and successfully in certain band combinations;

e) that the SFCG has agreed to adopt and utilize the 2, 7, 8, 32, and 34 GHz Deep Space Network channel plans when selecting frequencies for the deep space missions;

RECOMMENDS

1. that SFCG member agencies use the transponder turnaround frequency ratios listed in Table I below;

2. that SFCG member agencies utilize the Deep Space Network channel plans, Table II below, when selecting frequencies for Category B (deep-space) missions;

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1) Category B missions are deep space missions. Deep space is defined by the RR as distances from the Earth equal to or greater than $2 \cdot 10^6$ km.

2) CCSDS has adopted a similar Recommendation.

TABLE I - Frequency ratios and associated bands for Category B[(1)] missions

Frequency ratio	Allocated band (MHz)	Available[(2)] coherent band (MHz)	Allocated band (MHz)	Available(2) coherent band (MHz)
E-S/S-E	*E - S*	*E - S*	*S - E*	*S - E*
221/240	2110 - 2120	2110 - 2118	2290 - 2300	2291 - 2300
221/880	2110 - 2120	2110 - 2120	8400 - 8450	8402 - 8442
221/3344	2110 - 2120	2110 - 2120	(GHz): 31.8 - 32.3	(GHz): **31.93 - 32.08**
749/240	7145 - 7190	7147 - 7178	2290 - 2300	2290 - 2300
749/880	7145 - 7190	7150 - 7190	8400 - 8450	8400 - 8448
749/3328	7145 - 7190	7156 - 7190	(GHz): 31.8 - 32.3	(GHz): **31.80 - 31.95**
749/3344	7145 - 7190	7145 - 7190	31.8 - 32.3	**31.90 - 32.10**
749/3360	7145 - 7190	7145 - 7190	31.8 - 32.3	**32.05 – 32.25**
3399/3344	34.2 - 34.7	34.2 - 34.7	(GHz): 31.8 -32.3	**31.91 - 32.12**
E-S/E-S	*E - S*	*E - S*	*E - S*	*E - S*
221/749	2110 - 2120	2110 - 2120	7145 - 7190	7151 - 7185
221/3599	2110 - 2120	2110 - 2120	(GHz) 34.2 - 34.7	(GHz) **34.37 - 34.52**
749/3599	7145 - 7190	7145 - 7190	(GHz) 34.2 - 34.7	(GHz) **34.34 - 34.54**
S-E/S-E	*S - E*	*S - E*	*S - E*	*S - E*
240/880	2290 - 2300	2291 - 2300	8400 - 8450	8400 - 8433
240/3344	2290 - 2300	2290 - 2300	(GHz): 31.8 - 32.3	**31.91 - 32.05**
880/3328	8400 – 8450	8408 – 8450	(GHz) 31.8 - 32.3	(GHz): **31.8 - 31.96**
880/3344	8400 – 8450	8400 – 8450	31.8 - 32.3	**31.92 - 32.11**
880/3360	8400 - 8450	8400 - 8450	31.8 - 32.3	**32.07 - 32.26**

(1) Category B missions are deep-space missions. Deep-space is defined by the RR as distances from the Earth equal to or greater than $2 \cdot 10^6$ km.

(2) The available coherent band refers to the range of frequencies within which a set of channels that are coherent with those in another deep-space allocation may be specified. The band is determined by the frequency ratio and the allocation width. For the 2, 7, and 8 GHz bands, the available coherent band is approximately equal to the allocated band. For the 32 and 34 GHz allocations, the width of the available coherent band for a given frequency ratio is substantially less than the allocation width, and these cases are shown in bold face type.

TABLE II - Channel frequencies (in MHz) for Category B (deep-space) missions

BAND (GHz):	2 E-S	2 S-E	7 E-S	8 S-E	32 S-E	32 S-E	32 S-E	34 E-S
FACTOR:	221	240	749	880	3328	3344	3360	3599
CHANNEL		F2DN						
1	* 2108.878858	2290.185185	7147.286265	* 8397.345679	#31757.234568	# 31909.913580	#32062.592592	# 34343.235339
2	* 2109.219908	2290.555556	7148.442132	* 8398.703706	#31762.370379	# 31915.074083	#32067.777787	# 34348.789361
3	* 2109.560957	2290.925926	7149.597994	8400.061729	#31767.506176	# 31920.234571	#32072.962966	# 34354.343368
4	* 2109.902006	2291.296296	7150.753857	8401.419752	#31772.641973	# 31925.395059	#32078.148146	# 34359.897374
5	2110.243056	2291.666667	7151.909724	8402.777780	31777.777784	31930.555562	32083.333340	34365.451396
6	2110.584105	2292.037037	7153.065587	8404.135803	31782.913581	31935.716050	32088.518519	34371.005402
7	2110.925154	2292.407407	7154.221450	8405.493826	31788.049378	31940.876538	32093.703699	34376.559408
8	2111.266204	2292.777778	7155.377316	8406.851853	31793.185190	31946.037042	32098.888893	34382.113431
9	2111.607253	2293.148148	7156.533179	8408.209876	31798.320986	31951.197530	32104.074073	34387.667437
10	2111.948303	2293.518519	7157.689045	8409.567903	31803.456798	31956.358033	32109.259267	34393.221460
11	2112.289352	2293.888889	7158.844908	8410.925927	31808.592595	31961.518521	32114.444447	34398.775466
12	2112.630401	2294.259259	7160.000771	8412.283950	31813.728392	31966.679009	32119.629626	34404.329472
13	2112.971451	2294.629630	7161.156637	8413.641977	31818.864203	31971.839512	32124.814821	34409.883494
14	2113.312500	2295.000000	7162.312500	8415.000000	31824.000000	31977.000000	32130.000000	34415.437500
15	2113.653549	2295.370370	7163.468363	8416.358023	31829.135797	31982.160488	32135.185179	34420.991506
16	2113.994599	2295.740741	7164.624229	8417.716050	31834.271608	31987.320991	32140.370374	34426.545528
17	2114.335648	2296.111111	7165.780092	8419.074073	31839.407405	31992.481479	32145.555553	34432.099534
18	2114.676697	2296.481481	7166.935955	8420.432097	31844.543202	31997.641967	32150.740733	34437.653540
19	2115.017747	2296.851852	7168.091821	8421.790124	31849.679014	32002.802470	32155.925927	34443.207563
20	2115.358796	2297.222222	7169.247684	8423.148147	31854.814810	32007.962958	32161.111107	34448.761569
21	2115.699846	2297.592593	7170.403550	8424.506174	31859.950622	32013.123462	32166.296301	34454.315592

Note: Channel frequencies marked " * " are not within the Category B band allocation.

Channel frequencies marked " # " may be used in conjunction with the corresponding channel in a lower frequency band if that channel is not marked by " * ".

F2DN = N(10/27) + 2295 MHz, where N is in the range -13 to +28 for this Table. The value of F2DN is rounded to the nearest Hz. Frequencies in the 2 GHz E-S band are then computed and rounded to the nearest Hz. Channel numbers are equal to N + 14. Frequencies in other bands are derived from the 2 GHz E-S frequencies by using the corresponding ratio of frequency factors, and then rounding to the nearest Hz.

TABLE II (continued) - Channel frequencies (in MHz) for Category B (deep-space) missions

BAND:	2 E-S	2 S-E	7 E-S	8 S-E	32 S-E	32 S-E	32 S-E	34 E-S
FACTOR:	221	240	749	880	3328	3344	3360	3599
CHANNEL		F2DN						
22	2116.040895	2297.962963	7171.559413	8425.864197	31865.086419	32018.283950	32171.481481	34459.869598
23	2116.381944	2298.333333	7172.715276	8427.222220	31870.222216	32023.444438	32176.666660	34465.423604
24	2116.722994	2298.703704	7173.871143	8428.580248	31875.358027	32028.604941	32181.851854	34470.977626
25	2117.064043	2299.074074	7175.027006	8429.938271	31880.493824	32033.765429	32187.037034	34476.531632
26	2117.405092	2299.444444	7176.182868	8431.296294	31885.629621	32038.925917	32192.222213	34482.085639
27	2117.746142	2299.814815	7177.338735	8432.654321	31890.765432	32044.086420	32197.407408	34487.639661
28	2118.087191	* 2300.185185	7178.494597	8434.012344	#31895.901229	# 32049.246908	#32202.592587	# 34493.193667
29	2118.428241	* 2300.555556	7179.650463	8435.370371	#31901.037041	# 32054.407411	#32207.777782	# 34498.747689
30	2118.769290	* 2300.925926	7180.806327	8436.728395	#31906.172838	# 32059.567899	#32212.962961	# 34504.301695
31	2119.110339	* 2301.296296	7181.962190	8438.086418	#31911.308634	# 32064.728387	#32218.148140	# 34509.855701
32	2119.451389	* 2301.666667	7183.118056	8439.444445	#31916.444446	# 32069.888891	#32223.333335	# 34515.409724
33	2119.792438	* 2302.037037	7184.273919	8440.802468	#31921.580243	# 32075.049379	#32228.518514	# 34520.963731
34	* 2120.133487	* 2302.407407	7185.429782	8442.160491	#31926.716040	# 32080.209867	#32233.703694	# 34526.517737
35	* 2120.474537	* 2302.777778	7186.585648	8443.518518	#31931.851851	# 32085.370370	#32238.888888	# 34532.071759
36	* 2120.815586	* 2303.148148	7187.741511	8444.876542	#31936.987648	# 32090.530858	#32244.074068	# 34537.625765
37	* 2121.156636	* 2303.518519	7188.897377	8446.234569	#31942.123460	# 32095.691361	#32249.259262	# 34543.179787
38	* 2121.497685	* 2303.888889	* 7190.053240	8447.592592	#31947.259256	# 32100.851849	#32254.444442	# 34548.733793
39	* 2121.838734	* 2304.259259	* 7191.209103	8448.950615	#31952.395053	# 32106.012337	#32259.629621	# 34554.287799
40	* 2122.179784	* 2304.629630	* 7192.364969	* 8450.308642	#31957.530865	# 32111.172840	#32264.814816	# 34559.841822
41	* 2122.520833	* 2305.000000	* 7193.520832	* 8451.666665	#31962.666662	# 32116.333328	#32269.999995	# 34565.395828
42	* 2122.861882	* 2305.370370	* 7194.676696	* 8453.024689	#31967.802458	# 32121.493816	#32275.185174	# 34570.949834

Note: Channel frequencies marked " * " are not within the Category B band allocation.

Channel frequencies marked " # " may be used in conjunction with the corresponding channel in a lower frequency band if that channel is not marked by " * ".

F2DN = N(10/27) + 2295 MHz, where N is in the range -13 to +28 for this Table. The value of F2DN is rounded to the nearest Hz. Frequencies in the 2 GHz E-S band are then computed and rounded to the nearest Hz. Channel numbers are equal to N + 14. Frequencies in other bands are derived from the 2 GHz E-S frequencies by using the corresponding ratio of frequency factors, and then rounding to the nearest Hz.

Recommendation 11-1R2

USE OF THE BAND 1670-1710 MHz FOR METEOROLOGICAL SATELLITE SERVICES

The SFCG,

CONSIDERING

a) that the ITU Radio Regulations allocate the band 1670-1710 MHz to the Meteorological Satellite Service on a primary basis;

b) that the band could be used for both geostationary and low-earth orbiting satellites and their associated earth stations with thousands of stations worldwide;

c) that low-earth orbiting satellites, operating in bands below 1698 MHz have caused interference to geostationary transmissions.

RECOMMENDS

1. that the band 1670-1690 MHz be used for main earth stations at relatively few fixed locations for reception of raw image data and data collection from geostationary meteorological satellites;

2. that the band 1683-1690 MHz also be used for user stations for data dissemination (GVAR and S-VISSR) from geostationary meteorological satellites;

3. that the band 1690-1698 MHz be used for direct read-out services, data collection platform observations and data dissemination from geostationary meteorological satellites to user stations;

4. that the band 1698-1710 MHz be used for direct read-out and prerecorded image data transmissions from non-geostationary meteorological satellites.

Recommendation 12-2

USE OF THE 14.0 - 15.35 GHz AND 16.6 - 17.1 GHz BANDS FOR SPACE RESEARCH, CATEGORY A[1]

The SFCG,

CONSIDERING

a) that some SFCG member agencies are actively pursuing plans for space research missions which require very large bandwidths, e.g. spaceborne VLBI, geodesy and geodynamics;

b) that bandwidth requirements in excess of 10 MHz are increasingly difficult to satisfy in the frequency bands allocated to space research below 10 GHz;

c) that the 8450 - 8500 MHz region has been identified as appropriate for Category A missions requiring less than 10 MHz bandwidth, as specified in SFCG Recommendation 5-1R4;

d) that the 14 - 15.35 GHz band is densely occupied by the fixed service (14.3 - 15.35 GHz) and Earth-to-space links of the fixed-satellite service (14 - 14.8 GHz) and that, consequently, assignment of Earth-to-space links of the space research service is difficult;

e) that the 16.6 - 17.1 GHz band is allocated to radiolocation, primary and to space research, (deep space) (Earth-to-space), secondary;

f) that there are currently no plans by SFCG member agencies to use the 16.6 - 17.1 GHz band for space research, (deep space) (Earth-to-space), and that consequently, at a future competent World Radio Communications Conference, the limitation to deep-space should be suppressed;

g) that the sharing situation in the 14.0 - 15.35 GHz and 16.6 - 17.1 GHz bands, where the space research service has only a secondary status is difficult and does not lend itself to the use of classical modulation schemes which exhibit a high interference potential and a high susceptibility to interference;

h) that spectrum spreading types of modulation can considerably alleviate the sharing problems addressed above;

i) that SFCG members should ensure compatibility between their operations in the 14.0 - 15.35 and 16.6 - 17.1 GHz bands;

[1] Category A missions are those having an altitude above the Earth of less than $2 \cong 10^6$ km

j) that certain parts of the 14.0 - 15.35 GHz band have existing and planned assignments to data relay satellites (Earth-space, space-space);

RECOMMENDS

1. that the 14.0 - 15.35 GHz band be used for space-to-Earth transmissions of space research Category A missions;[2]

2. that the 16.6 - 17.1 GHz band be used for Earth-to-space transmissions of space research Category A missions;[3]

3. that the spectrum of data transmissions in the bands shall be sufficiently spread so as to ensure adequate protection for services operating in the band;

4. that existing and planned frequency assignments to data relay satellites (Earth-space, space-space) be protected.

[2] The 14.3 - 14.4 GHz and 14.47 - 14.5 GHz bands are not allocated to space research and will consequently have to be used in accordance with the provisions of RR 342.

[3] See Considering e) and f).

Recommendation 12-4R3

METHODS FOR REDUCTION OF POTENTIAL INTERFERENCE BETWEEN SYSTEMS IN THE SPACE SCIENCE SERVICES IN DENSELY OCCUPIED BANDS

The SFCG,

CONSIDERING

a) that certain frequency bands allocated to the science services are very densely occupied;

b) that frequency management methods, such as advance planning of a frequency assignment, may not always be successful because of the prevailing occupation of the bands;

c) that the temporary switch-off of emissions from a spacecraft is a recognized method to reduce the number of potential cases of interference;

d) that SFCG Procedures for Inter-Agency Frequency Coordination (RES A12-1) foresee that spacecraft transmissions can be temporarily interrupted in case of conflict among several missions and provides priority guidelines for such cases;

e) that the RR 22.1, Cessation of Emissions, demands that spacecraft be equipped with devices ensuring immediate cessation of emissions whenever required;

RECOMMENDS

1. that, as a general means of reducing potential interference in densely occupied bands, such as the 2200 - 2290 MHz and the 8025-8400 MHz bands, space agencies limit their space-Earth transmissions to those periods when they are in contact with a receiving earth station or a data relay satellite;

2. that, as a means to reduce the number of potential interference cases among spacecraft, space agencies be prepared to temporarily switch off emissions from the spacecraft concerned, in accordance with the priority guidelines laid down in Chapter 4 of the SFCG Procedures for Inter-Agency Frequency Coordination (RES A12-1);

3. that the devices on spacecraft used to switch off emissions postulated by RR 22.1 be designed with the highest practicable level of reliability and be qualified for a large number of switching cycles during the lifetime of the spacecraft.

Recommendation 12-5R1

LIMITATIONS ON EARTH-SPACE LINK POWER LEVELS[1]

The SFCG,

CONSIDERING

a) that occupation of frequency bands used by space agencies is increasing rapidly;

b) that in many cases the same frequency will be shared by several spacecraft;

c) that the 2025 - 2110 MHz band is also shared with space-to-space links from data relay satellites to user satellites, which are limited to relatively small power levels by the provisions of RR 2557 and are consequently particularly susceptible to interference;

d) that excessive EIRP from earth stations will make intra-service frequency sharing increasingly difficult and result in an inefficient use of the radio frequency spectrum;

e) that excessive EIRP from earth stations likewise unnecessarily complicates the coordination with terrestrial services and may increase in some cases the coordination area;

f) that the required EIRP from an earth station is determined by P_c/N_o, E_b/N_o, and the minimum signal level required by the spacecraft receiver;

RECOMMENDS

1. that space agencies limit the EIRP on Earth-to-space links to that required for safe spacecraft operation, by means of one or several of the following:

- avoid, whenever practicable, using high power transmitters having a fixed output but instead adjust the transmitted power to the minimum needed to meet project requirements;

- obtain the required EIRP by using reasonable antenna diameter in order to reduce both sidelobe radiation and transmitter power (Guideline: antenna diameter/rf wavelength equal to or greater than 70);

[1] CCSDS has adopted a similar recommendation (CCSDS401(3.2.1.)B-1).

- make compliance with REC ITU-R SA.509 a requirement in antenna specifications;

2. that spacecraft equipment designers endeavour to provide similar margins with regard to minimum Pc/No, minimum Eb/No and the minimum signal required by the spacecraft receiver.

Recommendation 13-3R1

DATA RELAY SATELLITE CHANNEL PLANS FOR THE 23 AND 26 GHZ BANDS

The SFCG,

CONSIDERING

a) that the frequency bands 22.55 - 23.55 GHz and 25.25 - 27.50 GHz are allocated to the inter-satellite service,

b) that the band 22.55 - 23.55 GHz is recommended for forward inter-orbit links from geostationary data relay satellites (DRS) to low-orbiting spacecraft and the band 25.25 - 27.5 GHz is recommended for return inter-orbit links from low-orbiting spacecraft to DRSs (Recommendation ITU-R SA.1019);

c) that data relay satellites are planned to use these bands for inter-orbit links;

d) that ESA, NASA and NASDA through the Space Networks Interoperability Panel (SNIP) have recommended that data relay satellites be designed to allow interoperable cross-support of each other's user spacecraft.

e) that SNIP has recommended a standard channel plan in these frequency bands;

RECOMMENDS

1. that DRS systems using the 22.55 - 23.55 GHz band for forward inter-orbit links use the following channel centre frequencies:

   23.205 GHz
   23.265 GHz
   23.325 GHz
   23.385 GHz
   23.445 GHz
   23.505 GHz

2. that these forward channels have a minimum bandwidth of 50 MHz;

3. that DRS systems using the 25.25 - 27.50 GHz band for return inter-orbit links use the following channel centre frequencies:

25.600 GHz
25.850 GHz
26.100 GHz
26.350 GHz
26.600 GHz
26.850 GHz
27.100 GHz
27.350 GHz

4. that these return channels have a minimum bandwidth of 225 MHz;

5. that data relay satellites be able to transmit forward signals on either left-hand or right-hand circular polarisation, and receive return signals on the same polarisation;

6. that data relay satellites transmitting a tracking beacon in these bands use one of the following frequencies;

23.530 GHz
23.535 GHz
23.540 GHz
23.545 GHz

7. that such tracking beacons be transmitted with left-hand circular polarisation.

Recommendation 14-1

PROTECTION OF DEEP SPACE RESEARCH EARTH STATIONS FROM LINE-OF-SIGHT INTERFERENCE IN THE BANDS 2290-2300 MHz, 8400-8450 MHz AND 31.8-32.3 GHz

The SFCG,

CONSIDERING

a) that, for deep space Earth stations, data availability objectives have been used to determine the maximum acceptable performance degradation;

b) that, based on the maximum acceptable performance degradation for these stations, the maximum allowable interference power at the deep space station receiver has been derived[1] and is:

Table 1: Maximum Allowable Interference Power to Deep Space Earth Station Receivers

Frequency	Maximum allowable interference power spectral density (dB(W/Hz))
2290-2300 (MHz) 8400-8450 (MHz) 31.8-32.3 (GHz)	-222.5 -220.9 -218.0

c) that, for the purpose of initiating a process of coordination, it is agreed that the corresponding maximum power spectral flux density is:

Table 2: Maximum Interference Power Spectral Flux Density

Frequency	Maximum interference power spectral flux density (dB(W/m Hz))
2290-2300 (MHz) 8400-8450 (MHz) 31.8-32.3 (GHz)	-257.0 -255.1 -251.0

[1] Recommendation ITU-R SA.578

d) that any source exceeding the maximum allowable interference power is potentially harmful to space research (deep space), whether that interference arises from a source operating in-band or from in-band spectral components arising from a source operating in an adjacent band;

e) that loss and subsequent reacquisition of deep space earth station receiver synchronization due to momentary interference in a low data rate channel results in a data outage significantly exceeding the duration of the initiating interference event;

NOTING

that a predicted interference potential exceeding the maximum power spectral flux density may be found acceptable on a case-by-case basis;

RECOMMENDS

1. that when a predicted interference potential exceeds the maximum interference power spectral flux density given in Table 2, the provisions of SFCG RES A12-1 shall be applied;

2. that the values given in Table 2 apply for sources whether operating directly in-band or out of band and producing in-band spectral components.

Recommendation 14-2R4

USE OF THE 37 - 38 GHz SPACE RESEARCH SERVICE ALLOCATION

The SFCG,

CONSIDERING

a) that the 37-38 GHz band is allocated to the space research service in the space-to-Earth direction;

b) that space-to-Earth links for missions to the sun-Earth libration point (L2) and future planetary missions using this band are characterised by very low signal levels because of their distance from Earth;

c) that the 37-38 GHz space research allocation may be used for space-to-Earth links for manned developmental lunar/planetary missions, for high data rate space-based astronomy systems (e.g., space VLBI) and for other space research service activities as needed;

d) that high density fixed service and fixed satellite service systems are planned to be operated in 37-38 GHz and 37.5-38 GHz respectively;

NOTING

that this Recommendation may have to be revised once final PFD limits have been adopted for the band 37.5-38 GHz at a future competent conference;

RECOMMENDS

1. that sun-Earth libration point (L2) missions and manned developmental lunar/planetary missions deciding to use the 37-38 GHz band implement their space-to-Earth links in the 37-37.5 GHz portion of the band, with associated Earth-to-space links in the 40-40.5 GHz band or other Earth to space bands as appropriate;

2. that Cat. A Space Research service missions, that can share with FSS, be accommodated in the 37.5-38 GHz portion of the band with associated Earth-to-space links in appropriate bands;

3. that high data rate space-based astronomy systems (e.g., S-VLBI) space-to-Earth links operating in the space research service in the 37-38 GHz band should take into account space-to-Earth links for future missions in the lower 500 MHz of the band;

4. that Member agencies take into account the information contained in the Annex when examining intra-service sharing in the 37-38 GHz band.

ANNEX TO REC 14-2R4

USE OF THE 37 - 38 GHz SPACE RESEARCH SERVICE ALLOCATION

This Recommendation provides guidelines for 37-38 GHz SRS downlink band partitioning. Some typical space research activities are recognized and a few major parameters of each activity are listed in Table I:

TABLE I

Activity:	Range (km)	Required or Requested Bandwidth (Min-Max) (MHz)	Spreading Loss Variation (dB)[1]	Range-Based Relative Performance (dB)
1) Planetary Exploration missions (Mars)	min 60E6 max 39E7	80 – 8000[3] 2 – 200[2]	16	-52+/-8
	2 000 000	(ITU-R	Planetary/Near Earth	Definition)
2) Libration point missions (L2, S-E)	1 500 000	200[4]	nil	-6
3) Lunar exploration missions	380 000	500[5]	nil	0 (Ref.)
4) High data rate space-based astronomy missions (e.g. S-VLBI)	typ: 5 000 - 40 000 max:2 000-400 000	1 000[6]	18 46	29+/-9 23+/-23
5) Missions employing Near Earth Orbiters	200 - 2 000	500[7]	20	56+/-10

Footnotes appear on the next page.

1) For constant spacecraft EIRP.

2) Present technology: (50W/5m dish)(50k/34m dish)(QPSK/R=1/2 code) supports 1-5 Mb/s at max Mars range (2-10 MHz required). Projected technology (100W/10m dish)(50k/70m dish)(Turbo) supports 100 Mb/s at max Mars range (200 MHz required). A bandwidth request of at least 100 MHz will not nearly fulfill the projected capability at min Mars range.

3) Minimum range bandwidths derived from the bandwidths projected for the maximum range.

4) ESA, 1999 proposal.

5) NASDA, 1998 request (METS).

6) NASA, 1998 request (ARISE). Two polarizations required.

7) Suggested maximum.

Recommendation 14-3R4

USE OF THE 8025-8400 MHz BAND BY EARTH EXPLORATION SATELLITES

The SFCG,

CONSIDERING

a) that Earth Exploration Satellites (EES) are an increasingly important tool for acquiring information about the Earth and its environment;

b) that the 8025-8400 MHz band is allocated to the EES service on a primary basis;

c) that the band 8025-8400 MHz is shared with the fixed, mobile and fixed-satellite (Earth-to-space) services and the band 8175-8215 MHz is also shared with the meteorological satellite (Earth-to-space) service;

d) that use of the band by EES operated by both commercial interests and space agencies is increasing and could result in harmful interference among EES systems;

e) that Earth-based, deep space research receivers operated in the adjacent 8400-8450 MHz band are extremely sensitive and highly susceptible to interference;

f) that time-critical events occur in both deep space research and EES operations,

g) that guidelines for use of the band are desirable to maximize the capacity of the band and to minimize harmful interference;

RECOMMENDS

1. that transmitters on Earth Exploration Satellites radiate only when transmitting data to one or more Earth stations;

2. that consultations be effected if unwanted emissions from an Earth Exploration Satellite exceed the deep space interference criterion of -220.9 dBW/Hz into a deep space receiver in the band 8400-8450 MHz.

Recommendation 15-1R2

USE OF THE 400.15-401 MHz SPACE RESEARCH ALLOCATION FOR PROXIMITY LINKS

The SFCG,

CONSIDERING

a) that the 400.15-401 MHz band is allocated to the space research service (space-to-space) on a primary basis for communications with manned space vehicles (S5.263);

b) that the 400.15-401 MHz band is particularly well suited for reliable and safe proximity communications at low data rates between space vehicles;

RECOMMENDS

1. that the 400.15-401 MHz space research allocation be used for low data rate space to space communications with manned space vehicles;

2. that other potential space research users such as wideband proximity operations and high data rate space-to-space links be encouraged to use other bands as appropriate (see REC 15-2R2).

Recommendation 15-2R4

USE OF THE BAND 25.25-27.5 GHz FOR INTER-SATELLITE (DATA RELAY SATELLITE AND PROXIMITY LINKS)

The SFCG

CONSIDERING

a) that Article 5 of the Radio Regulations allocates the 25.25-27.5 GHz band for the inter-satellite service, restricted to space research, Earth exploration-satellite, medical and industrial applications, on a primary basis;

b) that SFCG Recommendation 13-3R1 identifies the standard channel plan adopted by the Space Network Interoperability Panel (SNIP) for use by data relay satellite (DRS) networks;

c) that requirements for wide band proximity links in the 25.25-27.5 GHz band have been identified for high data rate communications between co-orbiting, free-flying radio elements;

RECOMMENDS

1. that DRS systems using the band 25.25-27.5 GHz avoid assignment of channels with the 25.60 GHz and 27.35 GHz centre frequencies for data relay return links to users operating proximity links in the bands 25.25-25.60 GHz and 27.225-27.5 GHz.

2. that the implementation of proximity operation communication links in the 25.25 - 27.5 GHz band be constrained to the sub-bands 25.25-25.60 GHz and 27.225-27.5 GHz;

Recommendation 17-1R2

PARAMETERS REQUIRED FOR CALCULATING THE COORDINATION DISTANCE AROUND AN EARTH STATION OPERATING IN THE EARTH EXPLORATION AND METEOROLOGICAL SATELLITE SERVICES WITH GEOSTATIONARY OR NON-GEOSTATIONARY SPACE STATIONS

The SFCG,

CONSIDERING

a) that Appendix 28/S7 of the Radio Regulations requires parameter values for use in calculating coordination distances in the 1670 - 1710 MHz, the 8025 - 8400 MHz, and the 25.5 – 27 GHz bands;

b) that WRC 97 adopted a new allocation for the Meteorological Satellite service (Space-to-Earth) in the band 7750 - 7850 MHz limited to non-geostationary satellite systems, and restricted the use of the band 7450 – 7550 MHz by the same service to geostationary satellite systems, taking into account S5.461A;

c) the upgrade to primary status of the Earth Exploration satellite service allocation in the 25.5 - 27 GHz band, by the WRC 97;

d) that parameter values have been established by SFCG for calculating coordination distances;

RECOMMENDS

that the technical parameters contained in the Annexes of this Recommendation be used in the calculation of coordination distances for Earth stations operating in the Earth Exploration-satellite and Meteorological satellite services;

ANNEX A TO REC 17-1R2

PARAMETERS REQUIRED FOR DETERMINATION OF COORDINATION DISTANCE FOR A TRANSMITTING EARTH STATION

Transmitting space radiocommunication service designation		Earth exploration-satellite, Meteorological satellite	
Frequency band (MHz)		401-403	
Receiving terrestrial service designations		Fixed, Mobile, Meteorological Aids	
Method			
Modulation at terrestrial station[1]		A	N
Terrestrial station interference parameters and criteria	p_0 (%)	0.01	0.01
	n	2	2
	p (%)	0.005	0.005
	N_L (dB)	0	0
	M_s (dB)	33	33
	W (dB)	0	0
Terrestrial station parameters	G_r (dB)	NA	NA
	ΔG (dB)	NA	NA
	T_r (K)	NA	NA
Reference bandwidth	B (Hz)	4×10^3	10^6
Threshold interference level	P_r (p) (dBW) in B	-131	-107

Notes to Annex A:

1 A: analogue modulation; N: digital modulation

ANNEX B TO REC 17-1R2

PARAMETERS REQUIRED FOR THE DETERMINATION OF COORDINATION DISTANCES FOR A RECEIVING STATION

Receiving space radiocommunication service designation			Meteoro-logical satellite	Meteoro-logical satellite Earth-Exploration Satellite	Meteoro-logical satellite (NGSO)	Meteoro-logical satellite (GSO)	Meteoro-logical satellite (GSO)	Meteoro-logical satellite (NGSO)	Earth exploration satellite	Earth exploration satellite
Frequency band (MHz)			400.15-401	460-470	1670-1710[1]	1670-1710[1]	7450-7550	7750-7850	8025-8400	25,500-27,000
Transmitting terrestrial service designations			Meteoro-logical Aids	Fixed, Mobile	Meteoro-logical Aids, Fixed, Mobile	Meteoro-logical Aids, Fixed, Mobile	Fixed, Mobile	Fixed, Mobile	Fixed, Mobile	Fixed, Mobile
Method										
Modulation at each station[2]			N	N	N	N	N	N	N	N
Earth station interference parameters and criteria	p_o (%)		0.012	0.012	0.006	0.011	0.002	0.001	0.011	0.25
	n		1	1	3	2	2	2	2	2
	p (%)		0.012	0.012	0.002	0.0055	0.001	0.0005	0.0055	0.125
	N_L (dB)		0		0	0	-	-	0	0
	M_s (dB)		4.3		2.8	0.9	-	-	4.7	11.4
	W (dB)		0		0	0	-	-	0	0
Terrestrial station parameters	E^3 (dBW) in B	A			50	50	55	55	55	
		N			37	37	42	42	42	
	P_r (dBW) in B	A			13	13	13	13	13	
		N			0	0	0	0	0	
	DG (dB)				-5	-5	0	0	0	
Reference bandwidth	B (Hz)		1775×10^2	85	10^6	4×10^3	10^7	10^7	10^6	10^7
Threshold interference level	P_r (p) (dBW) in B		-148	-178	-142	-177	-125	-125	-142	-120
Information Source			SA.1026-1		1-6/6 WP 7C	1-6/6 WP 7C	1-6/2 WP 7C F.758	1-6/6 WP 7C F.758	1-6/6 1-6/36 WP 7C	WP 7C

Notes to Annex B:

1 In the band 1670-1700 MHz an additional contour for coordination with the meteorological aids service is required as proposed by IA/17:
The coordination distance, d (km), for fixed earth stations in the meteorological-satellite service *vis-à-vis* stations in the meteorological aids service assumes a radiosonde altitude of 20 km and is determined as a function of the physical horizon elevation angle θ (degrees) for each azimuth, as follows:

$$d = 582 \left((1 + (0.254\theta)^2)^{0.5} - 0.254\theta \right) \qquad \text{for } \theta > 0$$

$$d = 582 \qquad \text{for } \theta \leq 0$$

The minimum and maximum coordination distances are (100 – f(GHz)/2) km and 582 km, and occur at physical horizon angles greater than 11° and less than 0 °.

2 A: analogue modulation; N: digital modulation.

3 *E* is defined as the equivalent isotropically radiated power of the interfering terrestrial station in the reference bandwidth.

ANNEX C TO REC 17-1R2

PARAMETERS REQUIRED FOR THE DETERMINATION OF COORDINATION DISTANCE FOR A TRANSMITTING EARTH STATION IN BANDS SHARED BIDIRECTIONALLY WITH RECEIVING EARTH STATIONS

Service designation to space service in which the *transmitting* earth station operates		Mobile-satellite	Mobile-satellite	Fixed satellite
Frequency bands (MHz)		1675-1710	1675-1710	8025-8400
Service designation to space service in which the *receiving* earth station operates		Meteorological satellite	Meteorological satellite	Earth exploration satelltie
Orbit[1]		Non-GSO	GSO	Non-GSO
Modulation at receiving earth station[2]		N	N	N
Receiving earth station interference parameters and criteria	p_0 (%)	0.006	0.011	0.011
	n	3	2	2
	p (%)	0.002	0.0055	0.0055
	N_L (dB)	0	0	0
	M_s (dB)	2.8	0.9	4.7
	W (dB)	0	0	0
Receiving earth station parameters	G_r[3] (dB)	30	45	
	Pattern[4]	ITU-R REC. S.465-5	ITU-R REC.S.465-5	
	q_{min}[5]	5°	3°	
	T_r[6] (K)	370	118	
Reference bandwidth	B (Hz)	10^6	4×10^3	10^6
Threshold interference level	$P_r(p)$ (dBW) in B	-142	-177	-142
Information source		1-6/6 WP 7C	1-6/6 WP 7C	1-6/6, 1-6/36 WP 7C

Notes to Annex C:

1 Orbit of the space service in which the receiving earth station operates (non-GSO or GSO).
2 N: digital modulation.
3 On-axis gain of the receive earth station antenna.
4 Antenna radiation pattern for the receive earth station (e.g. Appendix 1 to Annex 1 of ITU-R Recommendation IS.847-1).
5 Minimum elevation angle of operation in degrees (non-GSO or GSO).
6 The thermal noise temperature of the receiving system at the terminal of the receiving antenna (under clear-sky conditions).

Recommendation 18-1

USE OF THE BANDS 31.3 – 31.8 GHz and 36 – 37 GHz FOR EESS PASSIVE SENSING

The SFCG,

CONSIDERING

a) that 31.3 – 31.8 GHz is essential as the only window for remote sensing of surface information to be used in connection with the atmospheric profile temperature measurements performed in the 50 – 60 GHz band, and that in this band the data loss acceptable by the EESS (passive) is less than 0.01%;

b) that in a number of countries the upper part of this band, 31.5-31.8 GHz, is also allocated to Fixed and Mobile Services on a primary basis;

c) that 36 – 37 GHz is the most suitable band for snow detection (shallow snow, snow water equivalent) and has been used for the last 20 years for climatological studies of snow, sea ice, soil moisture, microwave vegetation index and land surface temperature;

d) that in the future a reduction of the current 1000 MHz bandwidth allocated from 36-37 GHz may become possible, in the light of technological developments;

e) that current and planned EESS passive sensors are centred on 36.5 GHz;

f) that the two bands serve different purposes and are unique in their nature;

RECOMMENDS

1. that the 31.3 – 31.8 GHz allocation be maintained for EESS (passive) without the addition of any new primary allocation to active services;

2. that the 36 – 37 GHz allocation be maintained for EESS (passive);

3. that, if at a future date, the reduction of the bandwidth in the 36-37 GHz band becomes feasible, the reduced band be centred on 36.5 GHz.

Recommendation 18-2

MINIMUM EARTH STATION G/T REQUIREMENTS FOR RECEPTION OF NON-GEOSTATIONARY EESS IN THE 8025-8400 MHz BANDS

The SFCG,

CONSIDERING

a) that the 8025 – 8400 MHz band is extensively used by the Earth Exploration Satellite Service for space-to-Earth transmissions;

b) that the ITU has defined PFD limits on the Earth's surface in the ITU RR S21.16 for the purpose of facilitating sharing between EESS and terrestrial services in the 8025-8400 MHz band, with which all spacecraft must comply;

c) that the space-to-Earth links in the 8025-8400 MHz band typically operate with suppressed carrier modulation and uncoded BER's between 10^{-3} and 10^{-5}, with 3dB link margin;

d) that with existing ITU PFD limits an Earth station G/T greater than or equal to 25 dB/K will achieve the performance in considering c);

RECOMMENDS

that users of the 8025-8400 MHz band utilise Earth stations with a G/T of 25 dB/K or more.

Recommendation 21-1
(provisional)

SPECTRUM CONSIDERATIONS FOR FORMATION FLYING SYSTEMS

The SFCG,

CONSIDERING

a) that a number of Member Agencies are planning space missions that make use of multiple spacecraft flying in various "distributed" configurations ranging from close proximity flying to widely separated constellations in both near-Earth orbit and in deep space;

b) that the spacecraft must have a sensory and control system in order to maintain a precise relative position;

c) that the spacecraft must have a sensory and control system in order to attain a specified attitude, with all spacecraft targeting the desired object;

d) that the spacecraft must be able to communicate with each other;

e) that radio-navigation links for formation flyers use, in most cases, omni-directional types of antennas, and power-limited transmitters;

f) that inter-satellite links must be designed so as to avoid interference with onboard communication systems;

g) that formation flyers operating at altitudes lower than that of geostationary orbit may make passive (receive only) use of GNSS signals;

h) that many frequency bands are available that could be used to support these communication links, each with its own advantages and disadvantages;

i) that timely guidance from the SFCG to mission planners on the selection of the optimal frequency bands, could save the mission(s) time and budget resources;

j) that several formation flying systems are planned to operate in the same L2 region;

k) that radionavigation satellite, space research and intersatellite service allocations may be suitable for use in maintaining communications and relative positioning between spacecraft flying in formation;

RECOGNISING

that the operation of Global Navigation Satellite Systems (GNSS) is a public safety service and emissions that could jeopardise such operation are to be avoided;

RECOMMENDS

1. that frequency bands allocated to the Radionavigation-Satellite Service (RNSS) below 6 GHz not be used for transmissions by formation flying systems;

2. that formation flying systems operating below 20,000 km utilise available GNSS signals for position and attitude determination whenever practicable;

3. that, for planning purposes, for intersatellite communications and navigation requirements, reference be made to the table of frequency bands shown in the annex to this Recommendation;

4. that, to avoid inter-system interference problems, agencies coordinate their design choices for systems planned to operate in the same spatial region.

ANNEX to REC 21-1

FREQUENCY BANDS SUITABLE FOR IMPLEMENTING CROSS-LINKS IN MULTIPLE SPACECRAFT "FORMATION FLYING" SYSTEMS

BAND	**FREQUENCY RANGE**	**SERVICE**	**COMMENTS**
S	2025 - 2110 MHz 2200 - 2290 MHz	SRS (space-to-space) SRS (space-to-space)	
Ku	13.75 – 14.3 GHz 14.5 – 15.35 GHz	srs srs	These allocations are secondary
Ka	22.55 – 23.55 GHz 25.5 – 27.0 GHz 32.3 – 33.4 GHz	ISS ISS ISS, RNSS	
W	59 – 64 GHz 65 – 71 GHz	ISS ISS	

Recommendation 21-2R2

EFFICIENT SPECTRUM UTILISATION FOR SPACE SCIENCE SERVICES ON SPACE-TO-EARTH LINKS; CATEGORY A

The SFCG,

CONSIDERING

a) that frequency bands allocated to the space science services are becoming more congested as space missions multiply, data rates increase and other services enter these bands;

b) that usage of spectrum beyond what is actually required increases the potential for interference to other users and at the same time may result in a higher susceptibility to interference from other users of the band;

c) that notified bandwidth requirements beyond the amount of spectrum actually required generally increases the coordination burden;

d) that the use of PCM/PM/Bi-phase or PCM/PM/NRZ modulation is only justified when a distinct carrier component is required and for symbol rates below 2 Ms/s [1];

e) that in some exceptional cases, such as data relay satellite inter-orbit links, PFD limits laid down in ITU/RR S 21.16 cannot be met with efficient modulation schemes;

f) that some frequency bands of the space science services are allocated with a secondary status resulting in very difficult sharing conditions, which may require the use of spread spectrum-type modulations;

g) that filtered modulation schemes have bandwidth characteristics which generally reduce coordination burdens and that spectrum shaping can be used to significantly reduce the occupied bandwidth;

h) that the use of sub-carriers shall be limited, as stipulated by SFCG REC 21-3;

i) that trellis-coded modulators act as an encoder and a modulator [2].

---

[1] For non spectrum modifying modulation, the symbol rate is defined as the baseband single line bit rate at the input of the RF modulator. See figure 2.

[2] For trellis-coded modulation, the symbol rate is defined as the baseband single bit rate at the input of an equivalent modulator. See figure 3

RECOMMENDS

1. that, with immediate applicability to all space science service bands, space agencies use the most bandwidth efficient modulation schemes practicable for their missions;

2. that, with immediate applicability to all space science service bands, PCM/PM/Bi-phase or PCM/PM/NRZ modulation shall only be used when a carrier component is technically necessary and for symbol rates below 2 Ms/s.

3. that the emitted spectrum[3] for all Space Science Services projects starting in/or after the year 2001 and that will utilize space-to-Earth link frequency assignments in the bands 2200–2290 MHz, 8025–8400 MHz and 8450–8500 MHz, adhere to the spectral emission masks in figure 1.

[3] Measured relative to the peak of the telemetry spectrum and excluding all spurious emissions.

Figure 1: Spectral Emission Masks

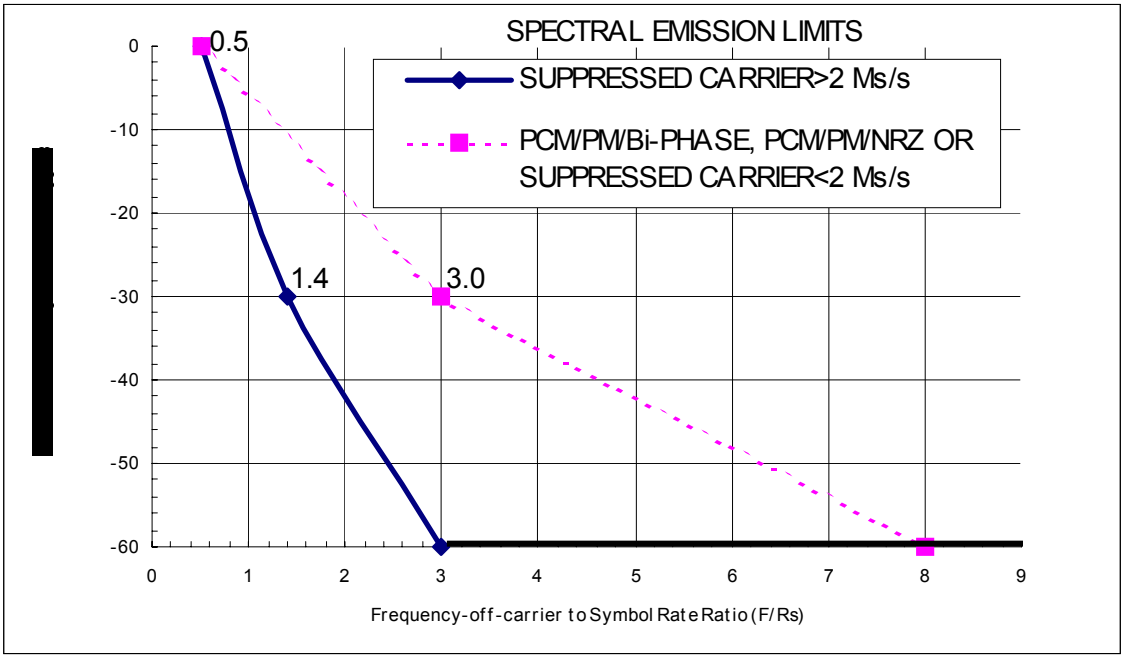


Figure 2: Non Spectrum Modifying Modulation Definitions

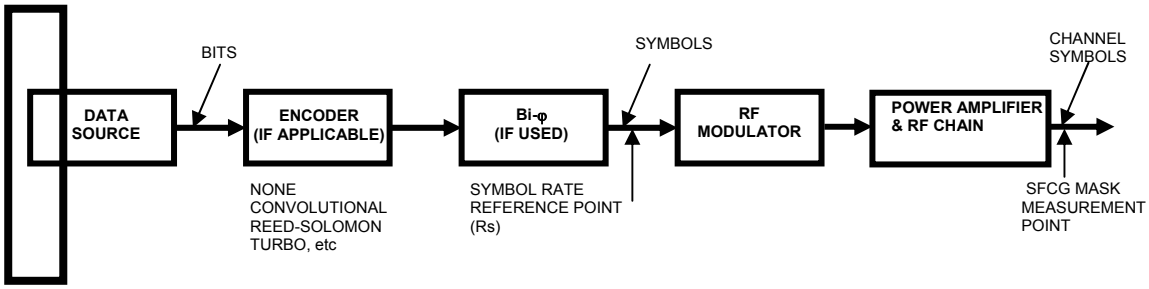
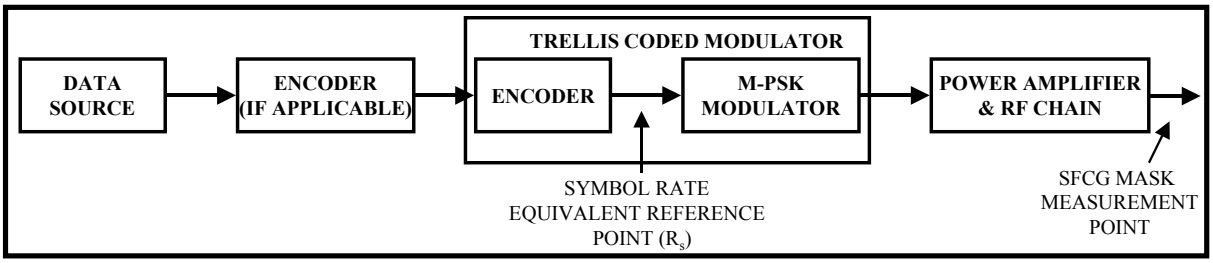


Figure 3: Trellis-Coded Modulation Definitions



Recommendation 21-3R1

USE OF SUB-CARRIERS FOR SPACE SCIENCE SERVICES ON SPACE-TO-EARTH LINKS; CAT. A

The SFCG,

CONSIDERING

a) that frequency bands allocated to the space science services are becoming more congested as space missions multiply, data rates increase, and other services enter these bands;

b) that usage of spectrum beyond what is actually required increases the potential for interference to other users and at the same time may result in a higher susceptibility to interference from other users in the band;

c) that sub-carrier modulation techniques require substantially more spectrum compared to suppressed carrier modulation techniques;

d) that the required bandwidth with sub-carrier modulation is a function of the sub-carrier frequency and the sub-carrier-to-symbol rate ratio;

e) that for telemetry sub-carrier frequencies above 60 kHz, a sub-carrier frequency-to-highest symbol rate ratio not exceeding 4 is generally sufficient to obtain acceptable performance;

f) that the presence of telecommand feed-through and/or ranging signals may require the selection of a slightly higher value of sub-carrier frequency-to-highest symbol rate ratio [1];

g) that sub-carriers are not required any longer to separate telemetry data streams because several channels can be present simultaneously on a single RF carrier if virtual channels are used [2];

---

1 CCSDS Recommendations 401.0 (2.4.14A) B-1

2 CCSDS Recommendation for Packet Telemetry (CCSDS 102.0-B-2)

h) that no technical reasons have been identified which would require the use of sub-carrier modulation for symbol rates above approximately 60 kilosymbol/second (ks/s) [3];

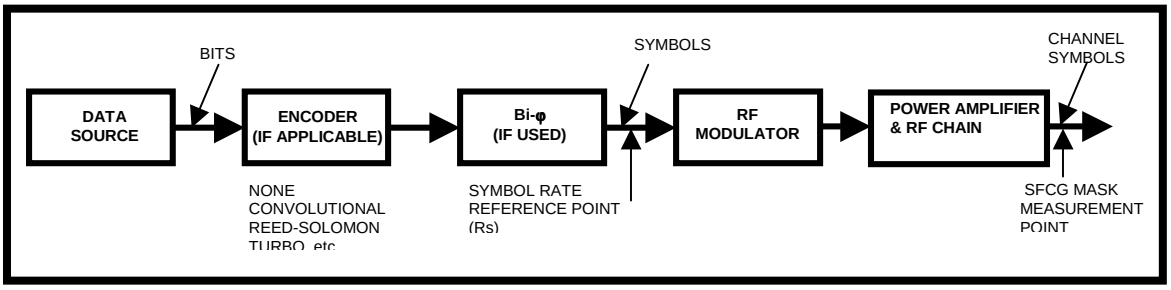
i) that eliminating sub-carriers simplifies both spacecraft and earth station data system complexity and reduces losses in the demodulation process;

RECOMMENDS

1. that, with immediate applicability to all space science service bands Cat. A, sub-carrier modulation shall not be used except where absolutely required and then only for symbol rates below or equal to 60 ks/s;

2. that, with immediate applicability to all space science service bands Cat. A, if a sub-carrier is required, it shall comply with the specifications set forth in considering e) and f);

Figure 1: Modulation Definitions



[3] For purposes of this Recommendation, the symbol rate is defined as the baseband equivalent single line bit rate following error correcting coding (if applicable) and Bi-phase encoding (if used) but excluding any other spectrum modifying modulation. See figure 1.

Recommendation 22-1R1

FREQUENCY ASSIGNMENT GUIDELINES FOR COMMUNICATIONS IN THE MARS REGION

The SFCG,

CONSIDERING

a) That a regional communication network can be expected in the foreseeable future at Mars as missions to Mars increase in number and variety;

b) That frequencies for direct communication between a spacecraft at Mars and an Earth station are provided in the existing allocations to SRS;

c) That separate frequencies are needed in the Mars region for compatible local communications between a surface vehicle and an orbiter, between surface vehicles, and between orbiters;

d) That major criteria for allocating frequencies include RF compatibility, technology availability and performance, operation scenarios, cost to the missions, and ability to conduct testing and emergency support from the Earth;

e) That, without sufficient frequency separation, a Mars vehicle receiving signals from the Earth can be easily interfered by a signal transmitted by itself or by a local Mars vehicle, and a Mars vehicle transmitting to the Earth can easily interfere with a local receiver;

f) That lower frequency provides better SNR performance for a communication link between two vehicles using low gain broad beam antennas, such as between a rover and a low orbiter;

g) That higher frequency provides better performance between two vehicles employing high gain antennas, such as between a large lander and an orbiter with accurately pointed antennas;

h) That testing Mars local link radios with signals transmitted from an Earth station is allowed only if it does not interfere with Earth-based radio systems operating in accordance with provisions of Radio Regulations; and that techniques such as self test on board are available to minimize the need for testing with Earth-based signals;

i) That the SFCG has resolved to provide assistance to member agencies in coordinating frequency assignment for deep space missions, including missions to Mars (see RES A 21-1);

j) That Mars missions need interoperable relay links to maintain communication with the Earth; and that such links in the UHF band have been defined in the CCSDS Proximity 1 standard;

k) That passive observations in space need to be protected to the extent provided in the Radio Regulations, particularly the quiet zone in the shielded area of the Moon.

RECOGNISING

a) That Mars local links must not interfere with the direct communication links between space and the Earth using frequencies provided in the ITU Radio Regulation;

b) That multiple frequency bands are needed for missions to meet various communications requirements and satisfy cost, mass and performance objectives.

RECOMMENDS

1. That agencies select frequencies from Table 1 for communications in the Mars region according to the specific applicability and precautions recommended in Table 2,

2. That testing Mars local links in flight with signals transmitted from an Earth station be minimized and strictly non-interfering to the Earth-based radio systems operating under the provisions of Radio Regulation;

3. That assignment of Mars local link frequencies be coordinated within the SFCG in accordance with RES A 21-1.

Table 1: Summary of Frequency Bands for Communications in the Mars Region

Space-to-Earth	2290-2300 MHz
	8400-8450 MHz
	31.8-32.3 GHz
Earth-to-space	2110-2120 MHz
	7145-7190 MHz
	34.2-34.7 GHz
Orbit-to-surface:	435-450 MHz**
	2025-2110 MHz
	7190-7235 MHz
	14.5-15.35 GHz
Surface-to-orbit:	390-405 MHz**
	2200-2300 MHz
	8400-8500 MHz*
	16.6-17.1 GHz
Surface-to-surface:	435-450 MHz
	390-405 MHz
	2025-2120 MHz
	2200-2300 MHz
Orbit-to-orbit:	435-450 MHz
	390-405 MHz
	2025-2120 MHz
	2200-2300 MHz
	7190-7235 MHz
	8450-8500 MHz
Approach Navigation & Atmosphere Radio Science	8400-8450 MHz

Multiple frequency bands are provided in Table 1 for each communication link. Table 2 presents specific recommendations on the use of these bands, including the merits and precautions that should be considered before choosing a band.

Figure 1 presents a graphic illustration of the vehicles and communication links, and a conceptual future scenario with frequency bands chosen from Table 1.

Note* - Using this band for the surface-to-orbit link is permitted in the near future when users are few. A user must coordinate with missions using the band for the Space-to-Earth link and operate on non-interfering basis. A user mission to be launched after January 1, 2015 must seek a waiver from the SFCG.

Note** - Operation in the reverse direction is permitted in the near term when users are few. A user must coordinate with missions using the band in the proper direction and operate on non-interfering basis. A user mission to be launched after January 1, 2010 must seek a waiver from the SFCG.

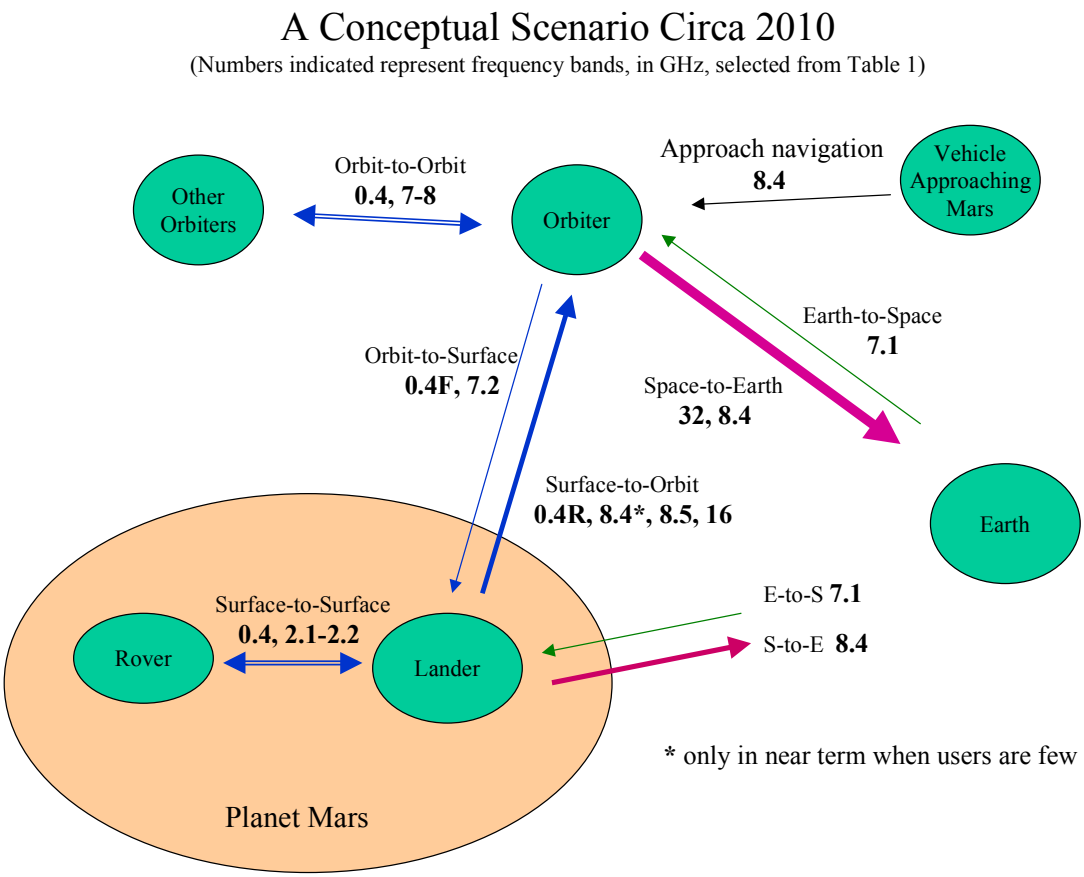


Figure 1

Note: In Figure 1, the numbers in GHz represents a subset of frequency bands from Table 1, as follows:

"0.4"	= 390-405; 435-450 MHz
"0.4F"	= 435-450 MHz
"0.4R"	= 390-405 MHz
"2.1-2.2"	= 2025-2120; 2200-2300 MHz
"7.1"	= 7145-7190 MHz
"7.2"	= 7190-7235 MHz
"7-8"	= 7190-7235; 8450-8500 MHz
"8.4"	= 8400-8450 MHz
"8.5"	= 8450-8500 MHz
"16"	=16.6-17.1 GHz
"32"	= 31.8-32.3 GHz

Table 2: Notes on Mars Local Link Frequencies Recommended in Table 1

Table 2: Notes on The Mars Local Link Frequencies Recommended in Table 1 *October 11, 2002*

General Comments:

1. All present and planned future missions to Mars use X-Band S-to-E and E-to-S links.

2. A few missions also carry S-Band S-to-E or E-to-S links. The S-Band uplink is restricted by IMT2000.

3. For all frequencies on this table, technology or equipmrnt is available in the industry.

4. Saturation or jamming refers to strong interfering signal overwhelming the receiver operating in the same band or adjacent band. For missions at Mars satuation happens only on the same vehicle, not likely between vehicles because of the large distance between them.

5. Cross interference refers to interference from one vehicle to another. For Mars missions, such interference is not likely to occur in the adjacent band.

	Data Rate Performance	Accurate Antenna Pointing for Performance	Mass and Volume	Possible Equipment Sharing with Deep Space Space-Earth Links	Self-Interference with Deep Space Space-Earth Links	Cross Interference with Deep Space Space-Earth Links	Testing with Signals Transmitted from an Earth Station	Comments
1.0 Space-to-Earth (S-to-E)								Per ITU-R RR
2.0 Earth-to-Space (E-to-S)								Per ITU-R RR
3.0 Orbit-to-Surface (Command)								
3.1 435-450 MHz	Best at low rate, with LGA	Not required with LGA	large	none	none	none	Only on non-interfering basis (NIB)	For low rate links
3.2 2025-2110 MHz	High rate, with MGA/HGA	Required with small beamwidth (A)	small	If the lander carries an S-Band E-S receiver (Note: Deep space E-to-S is restricted by IMT2000) it is possible to modify the receiver to operate at extended frequencies.	If the orbiter carries S-Band E-S, the S-Band local link transmitter could saturate the S-Band E-S receiver unless there is adequate isolation.	none	Coordination is easier, as the band is allocated to SRS E-S, near Earth, where similar transmissions operate, although at lower power.	For high rate links. Can't share X-Band equipment.
3.3 7190-7235 MHz	Higher rate, with HGA	Required with smaller beamwidth (1/4 A)	smaller	Possible to modify the X-Band E-to-S receiver to operate at extended frequencies.	The orbiter X-Band local link transmitter could saturate an orbiter X-Band E-S receiver unless there is adequate isolation.	none	High power transmission in urban area is restricted to protect fixed and mobile services. A lesser problem in rural areas.	For high rate links. Can share X-Band equipment. Must avoid self-interference to the X-Band E-to-S link

Table 2: Notes on Mars Local Link Frequencies Recommended in Table 1

3.4 14.5-15.35 GHz	Even higher rate than X-Band, with HGA	Required with even smaller angle (1/8 A)	even smaller than X-Band	none	none	none	NIB	For high rate links
4.0 Surface-to-Orbit (Telemetry)								
4.1 390-405 MHz	see 3.1	see 3.1	see 3.1	none	none	none	NIB	For low rate links
4.2 2200-2290 MHz	see 3.2	see 3.2	see 3.2	If the lander carriers S-Band S-E transmitter (2290-2300 MHz), it is possible to modify the transmitter to operate at extended frequencies.	An orbiter S-Band S-to-E transmitter could saturate the orbiter local link receiver unless there is adequate isolation.	none	NIB	For high rate links. Not as good as 4.4 which allows X-Band equipment sharing.
4.3 2290-2300 MHz	see 3.2	see 3.2	see 3.2	If the lander carries S-Band S-to-E transmitter, the local link can share the transmitter without modification.	An orbiter S-Band S-E link transmitter will saturate the orbiter S-Band local link receiver.	An orbiter with S-Band S-to-E link could interfere with the local link receiver if the latter is in its antenna beam.	NIB	For high rate links. Not as good as 4.4 which allows X-Band equipment sharing.
4.4 8400-8450 MHz	see 3.3	see 3.3	see 3.3	Can share without modification a lander X-Band S-to-E transmitter.	An orbiter X-Band S-E link transmitter will saturate the orbiter X-Band local link receiver.	An orbiter with X-Band S-to-E link could interfere with another orbiter receiving local X-Band link if the latter is near or in its antenna beam.	NIB	For high rate links. Must avoid cross-link interference from S-E links.
4.5 8450-8500 MHz	see 3.3	see 3.3	see 3.3	Possible to share a lander X-Band S-to-E transmitter modifed to operate at extended frequencies.	Orbiter X-Band S-to-E transmitter could saturate the orbiter local link receiver unless there is adequate isolation.	none	NIB	For high rate links
4.6 16.6-17.1 GHz	see 3.4	see 3.4	see 3.4	none	none	none	Already allocated to SRS, deep space, E-to-S, secondary	For higher rate links
5.0 Surface-to-Surface								
5.1 435-450 MHz and 390-405 MHz	see 3.1	see 3.1	see 3.1	none	none	none	NIB	For low rate links

Table 2: Notes on Mars Local Link Frequencies Recommended in Table 1

5.2 2025-2110 MHz and 2200-2290 MHz	Low rate with LGA. Higher rate possible with MGA.	LGA does not require pointing. MGA does.	see 3.2	If lander carries S-Band space-Earth equipment, it is possible to modify it to operate at extended frequencies.	If the lander uses S-Band for space-Earth links, there will be self-jamming between the space-Earth and the local links unless there is adequate isolation.	none	Testing in the 2025-2110 MHz band can be coordinated, as it is in SRS E-S band. Testing in the 2290-2300 MHz band is on NIB.	For higher rate link with line of sight.
5.3 2110-2120 MHz and 2290-2300 MHz	see 5.2	see 5.2	see 3.2	If a lander carries an S-Band space-Earth transmitter or receiver, it can be used for local link.	If the lander uses S-Band space-Earth links, there will be self-jamming between the space-Earth and the local links.	A third vehicle using S-Band space-Earth links may interfere with the local link receiver if it is near the local link receiver, or there is not enough antenna discrimination between the Earth link transmitter and the local link receiver.	The 2110-2120 MHz band is already allocated to SRS, deep space, E-to-S. Testing the 2290-2300 MHz is on NIB.	For higher rate link with line of sight.
6.0 Orbit-to-Orbit								
6.1 435-450 MHz and 390-405 MHz	see 3.1	see 3.1	see 3.1	none	none	none	NIB	For low rate links
6.2 2025-2110 MHz and 2200-2290 MHz	see 3.2	see 3.2	see 3.2	If an orbiter uses S-Band space-Earth link, it is possible to modify space-Earth link equipment to operate at extended frequencies.	If an orbiter uses S-Band space-Earth links, there will be self-jamming between the space-Earth and the local links unless there is adequate isolation.	none	Testing in the 2025-2110 MHz band can be coordinated, as it is in SRS E-S band. Testing in the 2290-2300 MHz band is on NIB.	For high rate links. Less likely to share equipment.
6.3 2110-2120 MHz and 2290-2300 MHz	see 3.2	see 3.2	see 3.2	If orbiter carries an S-Band space-Earth link, the local link can share the same equipment.	If one vehicle uses S-Band space-Earth links, there will be self-jamming between the space-Earth and the local links on the vehicle.	see 5.3	The 2110-2120 MHz band is already allocated to SRS, deep space, E-to-S. Testing the 2290-2300 MHz is on NIB.	For high rate links. Can not share equipment with X-Band S-E links.

Table 2: Notes on Mars Local Link Frequencies Recommended in Table 1

6.4 7190-7235 MHz and 8450-8500 MHz	see 3.3	see 3.3	see 3.3	Possible to modify the X-Band space-Earth link equipment to operate in the extended frequency range.	The X-Band transmitter could saturate the X-Band receiver on the same vehicle unless there is adequate isolation.	none	Testing in the 7190-7235 MHz band can be coordinated, as it is in SRS band. Testing in the 8450-8500 MHz band is on NIB.	For high rate llinks. Possible to share equipment with X-Band S-E link.
7.0 Mars Approach Navigation and Atmosphere Radio Science								
7.1 8400-8450 MHz	Radio metric measurement	Accurate pointing as existing on spacecraft for Earth link.	see 3.3	Sharing equipment with the X-Band S-to-E transmitter	Orbiter doing approach navifation does not operate the Earth link at the same time. Orbiter X-Band S-to-E transmitter will saturate the orbiter local link receiver. However, no simultaneously operation of the Earth link with local link is planned for approach navigation.	Cross Interference will not occure with approach navigation. It may happen with occultation radio science when receiver is in the beam of another orbiter transmitting the S-E link.	NIB	

GLOSSARY

ASA	Austrian Space Agency
ASC	Australian Space Council
ASO	Australian Space Office
BNSC	British National Space Center
BR	Radiocommunication Bureau of the ITU
CAST	Chinese Academy of Space Technology
CCIR	International Radio Consultative Committee (as of 1 March 1993 replaced by Radiocommunication Study Groups of the RB)
CEPT	European Conference of Postal and Telecommunications Administrations
CCSDS	Consultative Committee on Space Data Systems
CGMS	Coordination on Geostationary Meteorological Satellites
CITEL	Conference on Inter-American Telecommunications
CNES	Centre National d'Études Spatiales (France)
CONAE	Comisión Nacional de Actividades Espaciales (Argentina)
CSA	Canadian Space Agency
CSIRO	Commonwealth Scientific and Industrial Research Organization (Australia)
CSTG	Commission for International Coordination of Space Techniques for Geodesy and Geodynamics
DLR	Deutsche Forschungs - und Versuchanstalt fur Luft - und Raumfahrt e.V.
DoC Canada	Department of Communications, Canada
DSN	Deep Space Network

EDRS	European Data Relay System (ESA)
EESS	Earth Exploration Satellite service
EIRP	Effective isotropically radiated power
ESA	European Space Agency
EUMETSAT	European Meteorological Satellite Organization
G/T	Ratio of gain to noise temperature
GCOS	Global Climate Observing System
GSO	Geostationary satellite orbit
IFRB	International Frequency Registration Board (As of 1 March 1993 replaced by Radiocommunication Bureau of the ITU)
INPE	Instituto de Pesquisas Espaciais (Brazil)
INSA	Ingeniera y Servicios Aeroespaciales (Spain)
ISRO	Indian Space Research Organization
ITU	International Telecommunication Union
IUCAF	Inter-Union Commission of Frequency Allocations for Radio Astronomy and Space Science
IWG	Intersessional Working Group (of the SFCG)
LEO	Low earth orbit
MetSS	Meteorological Satellite service
NASA	National Aeronautics and Space Administration (USA)
NASDA	National Space Development Agency of Japan
NIVR	Nederlands Instituut voor Vliegtuigontwikkeling en Ruimtevaart
NOAA	National Oceanographic and Atmospheric Administration (USA)
PFD	Power flux density

RAS	Russian Academy of Science
RB	Radiocommunication Bureau of the ITU
RSA	Russian Space Agency
RR	Radio Regulations of the ITU
SG 7	Radiocommunication Study Group 7: Science Services (ex CCIR SG 7)
SNIP	Space Network Interoperability Panel
SBSA	Swedish Board for Space Activities
SSC	Swedish Space Corporation
TDRSS	Tracking and Data Relay Satellite System (NASA)
TTC	Tracking, telemetry, and command
UWB	Ultra Wide Band
WCRP	World Climate Research Program
WMO	World Meteorological Organization

SFCG Method of Operation

SFCG meets at approximately one year intervals. Resolution A2-1 (most recent version) describes the scheduling and location of these meetings. Each meeting is hosted by a member agency. At the conclusion of a meeting, an invitation for the next meeting is extended by a member agency.

Each SFCG meeting is chaired by a representative of the host agency. The Chairman serves from the time that the invitation from his agency is accepted until the conclusion of the meeting over which he presides.

English is the language used for the conduct of SFCG meetings and for documentation, in accordance with Resolution A2-2 (most recent version).

The secretariat function for SFCG is performed by the European Space Agency (ESA). The Head of the ESA Frequency Management Office (Code ESA/APP-W) acts as the Executive Secretary of SFCG. The Secretariat provides continuity in the affairs of SFCG and prepares the SFCG meetings, including development of an appropriate agenda. The Executive Secretary provides support to the Chairman for the conduct of each meeting.

The Secretariat provides written minutes of each meeting. These minutes include, in particular, the following items:

a list of input documents;
reports of working groups;
texts of new or revised Resolutions and Recommendations;
texts of new or revised Action Items;
texts of new Decisions, and a list of earlier Decisions still in effect;
other actions taken by the meeting;
matters of historical interest.

The several types of SFCG documentation are defined in Resolution A2-3 (most recent version).

Information documents and discussion documents are serially numbered by the Secretariat in the order of receipt prior to a meeting. The number includes identification of the SFCG meeting number, e.g., SF/20-4 refers to the fourth document received for consideration at SFCG 20.

Resolutions and Recommendations adopted by a meeting are numbered and classified according to the method described in *Classification and Numbering of SFCG Recommendations and Resolutions*, found in Section I of this handbook.

Action Items, and Decisions (other than decisions concerning documents) that are adopted during a meeting are numbered according to the meeting and serial number, e.g., AI/20-6.

HOSTS OF SFCG MEETINGS

SFCG 1	CNES, France	12 - 14	November,	1980
SFCG 2	DFVLR, Germany	29 2	September - October,	1981
SFCG 3	ISRO, India	15 - 19	November,	1982
SFCG 4	DTI/RAL, United Kingdom	14 - 18	November,	1983
SFCG 5	NASA, USA	22 - 26	October,	1984
SFCG 6	NASDA, Japan	21 - 25	April,	1986
SFCG 7	ESA, France	16 - 20	November,	1987
SFCG 8	CNIE, Argentina	9 - 16	November,	1988
SFCG 9	SBSA/SSC, Sweden	28 1	August - September,	1989
SFCG 10	NASA/NOAA, USA	1 - 5	October,	1990
SFCG 11	INTA, Spain	17 - 23	April,	1991
SFCG 12	ASO/CSIRO, Australia	28 5	October - November,	1992
SFCG 13	CSA, Canada	13 - 21	October,	
SFCG-14	EUMETSAT, Germany	14 - 22	September,	1994
SFCG 15	ISRO, India	17 - 15	December,	1995
SFCG 16	RSA/ISDE, Russia	25 3	September - October,	1996
SFCG 17	NASA, USA	17 - 25	September	1997
SFCG 18	NASDA, Japan	9 - 17	September	1998
SFCG 19	ESA, The Netherlands	8 – 15	September	1999
SFCG 20	CSIRO, Australia	7 – 16	November	2000
SFCG 21	CNES, French Guiana	26 4	September – October	2001
SFCG 22	ASI, Italy	9-16	October	2002

SFCG 23	NASA/NOAA	17-25	September	2003

THE SFCG SILVER PIN FOR MERITORIOUS SERVICE

The following individuals have received the SFCG Silver Pin Award for Meritorious Service: [1)]

Awarded at SFCG 12, 5 November, 1992:

Michel Alonso	CNES
Gerhard Block	ESA
Robert Bowen	DoC, Canada
Daniel Breton	CNES
Boris Doubinski	RAS
Norman de Groot	NASA/JPL
Yasushi Horikawa	NASDA
Fred Horner	IUCAF
Karyl Irion	NASA/ARC
D.W.H. Johnston	NASA
Nobuhiro Kawajiri	NASDA
John Kelleher	NASA
John Kiebler	NASA
Harold Kimball	CCIR, (ex-NASA)
Wilhelm Kraemer	DLR
K.S. Mohanavelu	ISRO
Manfred Otter	ESA
James Scott	NASA
Véronique Simpson	ESA
Robert Taylor	NASA
Luis Vadillo	INTA

Awarded at SFCG 13, 21 October, 1993:

Warren L. Martin	NASA/JPL
Robert Wolf	EUMETSAT
David Struba	NASA

Awarded at SFCG 15, 15 December, 1995:

Shayla Davidson	NASA
S. Sayeenathan	ISRO

Awarded at SFCG 16, 3 October, 1996:

Jean-Luc Gerner	ESA
Mikhail Vasiliev	RISDE

1) See Glossary for meaning of acronyms and abbreviations.

Awarded at SFCG 17, 25 September, 1997

Arvind Bastikar	CSA
Franz Borncamp	NASA/JPL
Richard Jacobsen	CSIRO

Awarded at SFCG 18, 17 September, 1998

Korehiro Maeda	NASDA
David McGinnis	NOAA

Awarded at SFCG 19, 15 September, 1999

Albert Nalbandian	ITU-BR

Awarded at SFCG 20, 16 November, 2000

Edoardo Marelli	ESA

Awarded at SFCG 21, 4 October, 2001

John Zuzek	NASA

Awarded at SFCG 22, 16 October 2002

Wayne Whyte	NASA

Awarded at SFCG 23, 21 September 2003

Enrico Vassallo	ESA

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(S F C G)

Members & Observers

For delegations with several members listed the Delegation Coordinator is identified by an asterisk. Delegates authorised to input frequency data under the provisions of RES A21-2 are identified by a double asterisk.

September 2003

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